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THE BACTERIOLOGICAL FINDINGS IN PUERPERAL SEPSIS.[1]

By LUCY M. BRYCE, B.Sc., M.B., B.S. (Melbourne),
From the Walter and Eliza Hall Institute of Research, Melbourne Hospital.

IN compiling these notes on the bacteriological findings in puerperal sepsis I have taken as a basis the results of routine investigations made by the staff of the Women's Hospital, and those of the work we carried out during 1926-1928 for the Obstetric Research Committee at our two maternity hospitals, the Women's and the Queen Victoria. I have supplemented these by references to some of the researches of workers in other countries. These references must of necessity be brief and incomplete, as it would be impossible in the time at my disposal to discuss the vast amount of literature which has accumulated since the pioneer work of Döderlein in the 'eighties and 'nineties, and Schottmüller a little later. During the last decade or so especially has great attention been paid to the problems of puerperal sepsis owing to the increasing concern felt at the lack of improvement in the maternal mortality rates in spite of all endeavours to better the conditions under which child-birth takes place, and in spite of the improvement in the general death rate.

Coming now to the discussion of the actual bacteriological findings in individual cases or series of cases of puerperal sepsis, I will first deal with blood culture, as I propose to consider the different types of the disease (in so far as it is possible to divide it into different types) and the related bacterio-

[1] Read at a meeting of the Victorian Branch of the British Medical Association, on July 1, 1931.

logical findings in the following order: (i) The very severe, generalized and often fatal type in which septicæmia due to a specific organism is usually a feature. (ii) Localized disease of all degrees, from comparatively mild to severe prolonged illness, which can usually be shown to be also due to infection by one definite pathogenic organism. (iii) Mild morbidity lasting only a short time, and as I will show later, probably not caused by definite infection with any specific organism.

I will then consider the relationship of the bacteriological findings in each type of disease to the conditions found in the normal puerperium and, lastly, the parts played by the organisms present in the genital passages *ante partum* and those from external sources in the production of puerperal sepsis.

Blood Culture.

Table I shows briefly the relationship of blood culture to mortality in all the cases admitted to or occurring in our own Women's Hospital over the five-year period from 1926 to 1930 and in several other similar groups of cases studied in other countries. I wish to take this opportunity of thanking both Dr. Mollison, for permission to include here his and Dr. Bearham's results, and Dr. Worcester, the Medical Superintendent, for giving me ready access to the hospital records.

From these figures it will be seen that when hæmolytic streptococci of the type usually spoken of as *Streptococcus pyogenes* are present in the blood stream, the mortality is in the region of 70% (Women's Hospital 79%, Colebrook 66%, Bourne 66%), and conversely that these streptococci are the organisms present in such a large percentage of severe cases that we must regard them as mainly responsible for severe sepsis.

But we cannot fail to notice the very divergent results obtained by Colebrook in his later series, which have caused him to change his views somewhat radically. While in his earlier series 16 out of 18 infections were found to be due to *Streptococcus pyogenes,* in his later series only six out of 17 were due to this organism and seven were due to anaerobic streptococci.

Colebrook in this paper also refers to the statement of Schottmüller in a review published in 1928

TABLE I.

Relationship of Blood Cultures to Mortality.

	Number of Cases.	Positive Blood Cultures.	No Cultures Obtained.	Cases in which No Attempt at Blood Culture Was Made.
Women's Hospital, 1926-1930	Fatal 67	49: Streptococci ..... 42 Staphylococci ..... 4 *Bacillus coli* ..... 2 *Bacillus welchii* 1	15	3
	Non-fatal .. 295	23: Streptococci ..... 11 Staphylococci ..... 4 *Bacillus coli* ..... 7 *Bacillus welchii* 1	98	174
Colebrook, 1924-1926	Fatal 18	18: Streptococci ..... 16 Staphylococci 2	0	0
	Non-fatal .. ?	8: Streptococci ..... 4 Green streptococci ..... 1 *Bacillus coli* 3	Many	?
Bourne, up till 1928	Fatal 51	35 streptococci (No other organisms discussed)	16	0
	Non-fatal .. 85	18 streptococci	63	0
Armstrong and Burt-White, 1929	Severe cases 20	10 streptococci	5	5
Colebrook, 1929-1930	Fatal 17	17: Hæmolytic streptococci .... 6 Anaerobic streptococci ..... 7 Staphylococci ..... 1 *Bacillus coli* ..... 2 *Bacillus proteus* 1	0	0
	Non-fatal .. 61	17: Hæmolytic streptococci .... 6 Anaerobic streptococci .... 10 *Bacillus coli* 1	44	0
Schwarz and Dieckmann, 1924-1926 .	66	15: Anaerobic organisms ..... 6 Anaerobic streptococci ..... 10 1 fatal case	53	0

that, contrary to general belief, hæmolytic streptococci were responsible for only a third of his fatal cases, including both septicæmic and localized infections, while anaerobic streptococci were responsible for a slightly larger number, the culture tubes from the remainder presumably being sterile or yielding other organisms.

Schottmüller's view is regarded as extreme, even by his German colleagues, but is supported to some extent by an analysis by Sommer of 261 cases of generalized infection occurring in Berlin. He found that anaerobic streptococci came next in importance to aerobic hæmolytic streptococci as infecting agents in *post partum* septicæmia.

In America Schwartz and Dieckmann in 1927 stressed the importance of anaerobic streptococci, pointing out that until the special technique required to isolate these organisms satisfactorily was used, they encountered many puzzling cases in which clinically there was undoubted generalized infection, but in which attempts at ordinary aerobic culture yielded negative findings. Their results are somewhat divergent from those of other authors in that the mortality in their bacteriæmic cases is so low, although ten deaths occurred altogether among their 68 patients.

As regards the incidence of these forms in cases at the Women's Hospital it is not possible to give a very definite statement, as no special technique for their isolation has been used, effort having been concentrated towards the isolation of aerobic hæmolytic forms, which have hitherto and still are by many leading authorities considered of such paramount importance. Dr. Mollison has, however, sometimes encountered streptococci in primary blood culture which failed to grow on aerobic subculture, and which after some days caused blackening and odour in the original broth, thus apparently possessing two of the characteristics which caused Schottmüller to call his anaerobic form *Streptococcus putridus*. I understand that also some investigations on this point have recently been made at the Baker Institute, in cooperation with the Women's Hospital.

To explain the discrepancy between his two series Colebrook is inclined to think that the absence of anaerobic organisms from his earlier series was due to inadequate technique, but it would seem that since he obtained definite growth of other organisms rather than the negative results which one would expect from faulty technique, some other factor must be partly responsible. Although he discards it in favour of the faulty technique explanation, Colebrook discusses also among other possibilities that of variations from time to time and place to place of the infective power of different organisms, in a manner similar to that which he says is known to occur in respiratory infections. In puerperal sepsis in which anaerobic streptococci were found, there was very little evidence of epidemic spread, and as far as I know these organisms are not known to exist in other parts of the body, so that one cannot assume an extragenital origin for these infections. On the other hand, some authors state that the organisms are present in the vagina, both *ante partum* and *post partum*, and in my own series there were present in a few cases, both in pregnancy and the puerperium, organisms which somewhat resembled those described by Colebrook.

Another point which Colebrook stresses is the prognostic importance of the number or increase in number, rather than the mere presence, of organisms in the blood (the number being estimated as colonies per cubic centimetre). For example, a strongly contracting uterus, particularly after an abortion, may force organisms of any kind present in the uterine cavity intermittently into the blood stream, and organisms of several varieties, including harmless saprophytes, may grow in a culture tube inoculated when the temperature first rises in a case of this type. Such organisms, however, quickly disappear, and a culture of this nature may be followed by failure of organisms to grow in a day or two, with probably a corresponding improvement in the patient's condition. Suppose, however, a culture tube reveals a scanty growth, say five colonies per cubic centimetre, of *Streptococcus pyogenes*, one may feel doubtful of the significance of so few organisms. If, however, on repeating the culture there is an increase to 100, and perhaps on a third culture to 1,000 colonies per cubic centimetre, such finding would indicate a progressive infection and a very grave prognosis.

Summarizing, then, the significance of blood cultures, we find that:

1. All workers recognize the importance of hæmolytic aerobic streptococci as the chief causative agent in severe septicæmic puerperal sepsis.

2. Some consider that anaerobic streptococci also play an important part, and that attempts should be made to isolate them, especially if on ordinary aerobic culture media no growth occurs in clinically likely cases.

3. A few cases due to other organisms, such as *Staphylococcus aureus, Bacillus coli* and *Bacillus welchii,* will be met with in any sufficiently large series.

4. It should be noted here that if the value of any form of intravenous therapy, serological or chemical, alleged to be especially inimical to any particular organism is to be correctly assessed, it is, of course, necessary to know whether the organism is the infecting agent.

The second group of cases to be considered is that in which, though blood cultures cannot be obtained, there is local disease of varying degree of severity with or without general intoxication and sometimes with fatal ending. In those cases of this type in which it is possible to make bacteriological examination of the lesion (for example, in endometritis where a uterine swab can be taken, in cases of pelvic inflammation or peritonitis where pus can be examined, or even sometimes in disease

of more remote parts, probably due to temporary bacteriæmia) the available published reports show that in these also hæmolytic streptococci are the chief infecting agent, although, as in the septicæmic infections, anaerobic streptococci and occasionally other organisms will be also encountered.

We come now to the large group of cases with mild morbidity comprising the majority of puerperal febrile conditions of genital origin. Armstrong and Burt-White point out, and I think it will be generally agreed, that there has been up to the present no precise definition separating these from the lesser degrees of streptococcal infection from which it may indeed be difficult to distinguish them clinically, particularly when the latter is localized to the uterus or its adjacent tissues. They suggest that it would clarify the confusion if we spoke of and thought of all infections known to be due to streptococci as "puerperal fever," thus regarding it as a clinical entity due to a specific organism, in the same way as we do typhoid fever. If in a febrile case hæmolytic streptococci are not present, the condition is not, they consider, the definite disease due to a specific organism which they would call "puerperal fever," and therefore may be referred to in a general way as puerperal morbidity. These authors urge that it is important that these two groups of local disease should be distinguished, and suggest as a practical way of doing this, that whenever a rise of temperature which is likely to be due to infection occurs, a swabbing should be taken from the cervical canal. If *Streptococcus pyogenes* is present a guarded prognosis should be given and steps then taken to prevent the spread of infection.

I think we can agree with Armstrong and Burt-White that the presence of *Streptococcus pyogenes* in the uterus necessitates a guarded prognosis, but it should be noted, as we know from our own experience, that they may be present without causing severe disease, a fact which is no doubt due to the great variation in resistance to their invasion shown by different individuals. It is quite likely, however, that in the cases described by Dr. Edward White (in his paper published in THE MEDICAL JOURNAL OF AUSTRALIA in 1927) in which intrauterine interference apparently converted mild morbidity into severe streptococcal septicæmia, streptococci were being harboured in the uterus. The knowledge gained by culture from the uterine cavity (or failing that, the cervical canal) would therefore help in deciding whether interference could be considered at all, if thought advisable from other aspects, or whether, as when streptococci were found to be present, it was definitely contraindicated owing to the risk of their dissemination. I would rather tentatively suggest also that it may happen that in some cases of this kind the balance between the patient's resistance and the infective powers of the invading organisms is very fine and that in these the administration of antistreptococcal serum or other procedures which aim at increasing the patient's power to deal with the infecting organism, may be of some use in turning the scale in her favour.

It seems, therefore, that knowledge of the presence of hæmolytic streptococci in the uterus in mild or early morbidity has a threefold value: (i) It influences prognosis, (ii) it suggests some forms of treatment and contraindicates others, (iii) it may prevent spread by indicating the need for isolation.

Turning to the second subdivision of the group of cases showing mild morbidity, that is, those in which streptococci are absent, we must now consider whether any assistance in dealing with this condition can be gained from a knowledge of the types of organism present.

It has long been known that normally the cervical canal and uterus, which are sterile immediately after birth, within a few days or even hours, become invaded by organisms. The cervix is almost invariably infected by the third day and the fundus by the fifth. After this the organisms gradually disappear and by the eighth or tenth day the uterus is usually sterile again. The organisms which I found in a series of normal puerperal cases included staphylococci, streptococci (occasionally hæmolytic, more frequently non-hæmolytic), diphtheroids, coliform bacilli, vaginal bacilli and occasionally other organisms, such as Gram-positive sporing bacilli, and a pleomorphic Gram-positive organism, to which I have referred above as being possibly related to the anaerobic streptococci described by Colebrook. This list is almost identical with that given by Armstrong and Burt-White as a result of their investigations of the normal flora of the puerperal uterus. This reference to the bacteria found in the normal puerperal uterus has been introduced here because both Armstrong and Burt-White's and my own experience supports their statement that, if we exclude the cases falling into their group of "puerperal fever" (that is, general or local streptococcal infection), there is no essential difference in type between the organisms of the normal and the morbid puerperal uterus. There is, however, very often a difference in number, a much more profuse growth often being obtained from morbid patients, with sometimes a relative increase in organisms such as fæcal streptococci and coliform bacilli which, though usually harmless, may become pathogenic.

An explanation of this increase in number is readily forthcoming if, as Armstrong and Burt-White suggest, we attribute the chief rôle in the production of this type of morbidity to the lacerations and bruising incidental to prolonged or difficult instrumental labour. The devitalized tissues, retained fragments of membrane and exudate from wounded surfaces make an excellent culture medium on which the normally present organisms can flourish even more copiously than usual. If in addition obstruction to the free drainage of lochia occurs, there will accumulate in the uterus the products of this flourishing growth, which may include many breakdown products of protein and other substances known to be toxic if introduced into the

blood stream. Under such conditions some of these must almost inevitably be absorbed and therefore set up the well known train of symptoms associated with this type of morbidity and usually referred to as sapræmia. The immediate improvement so often associated with promotion of drainage and removal of pabulum, and the short period of fever, usually corresponding to the known time of invasion and occupation of the uterus by the puerperal flora, both support the above explanation of the causation of this type of morbidity.

Summing up, therefore, the value of bacteriological investigations of the puerperal uterus, we may say that:

1. If organisms, such as aerobic hæmolytic or anaerobic streptococci, known to be usually or often associated with severe illness, are found to be in large numbers, especially if in pure culture, the condition must be regarded as serious and the knowledge obtained has the threefold value of indicating prognosis, treatment and need of isolation mentioned above.

2. If these organisms are scanty or in mixed culture, their presence is probably not of such great significance as regards the individual, but they may still be capable of infecting others. Armstrong and Burt-White suggest that the cervix should be swabbed in all cases of puerperal pyrexia and that those harbouring *Streptococcus pyogenes* should be segregated, in the same way in which during an outbreak of diphtheria those with positive throat swabs are isolated.

3. If a mixture of relatively unimportant saprophytes is the only finding, treatment directed towards the promotion of free drainage rather than any antibacterial measures is probably indicated.

Genital and Extragenital Organisms.

The foregoing notes have all been concerned with the bacteriological findings in cases in which morbidity has already developed, and such findings lead naturally to the question as to whether the organisms which gain entry to the uterus during the puerperium, both in normal and septic cases, are usual or common inhabitants of the genital tract at other times or whether they are introduced from external sources.

As you all know, an immense amount of research has been done in many countries on this subject. In a review of the earlier portions of this work Kantor and Pilot report that streptococci have been found in the vagina during pregnancy by different observers in 4% to 50% of cases, but most of these earlier workers do not draw the distinction between hæmolytic and non-hæmolytic forms, which is regarded as so important at the present time, and have not always specified which part of the genital tract was examined. It is obvious and also proved by experiment that the lower parts of the vagina will harbour organisms more freely than the fornices or the cervical canal.

I have therefore summarized only a few of the more recent series of cases. These are shown in Table II. From these it will be seen that hæmolytic streptococci (particularly *Streptococcus pyogenes* as defined by Burt-White and Armstrong), the commonest type found in puerperal sepsis occur but rarely in the genital tract, particularly the cervical canal *ante partum*, and what is perhaps even more important, in more of the sum total (over 700) of these modern series of cases, in which the technique is sufficiently similar, I think, to make them comparable, has the presence of hæmolytic streptococci in the genital passages *ante partum* been associated with severe puerperal fever. On the other hand, in one of Burt-White and Armstrong's cases in which they were absent *ante partum*, the patient developed streptococcal septicæmia in the puerperium, and in this instance there was a history of contact with another septic patient. There is also a suggestion from one of my cases that the reverse may take place, that is, development of resistance to a potentially pathogenic organism which has been present for some length of time *ante partum*.

TABLE II.

Streptococci in Vagina Ante Partum.

Investigator.	Number of Cases.	Non-Hæmolytic Streptococci Present.	Hæmolytic Streptococci Present.
Kanter and Pilot, Illinois, United States of America, 1924 ..	196	56%	2·5%
Houlton, Royal Free Hospital, 1924	96	2	
Bigger and Fitzgibbon, Rotunda, 1925	58	35 = 55%	0
Lockhart, Saint Thomas's, 1925	100	47 = 47%	1 = 1%
Burt-White and Armstrong, Saint Bartholomew's, 1928	153	Aerobic 24 Anaerobic 33	Aerobic 12 Anaerobic 22 (Only one of these was true *Streptococcus pyogenes*)
Bryce, Women's and Queen Victoria, 1928	119	28 = 23%	Present in one patient = 0·9%

In this patient who gave a history of very recent coitus, during which the organism may have been introduced, I found, four weeks prior to delivery, a hæmolytic streptococci virulent to mice and possessing the fermentation reactions of *Streptococcus pyogenes*. A swabbing taken eleven days later showed similar streptococci, hæmolytic and virulent to mice, but with lessened fermentative activity, while one taken on the fourth day of the puerperium showed streptococci with a similar degree of fermentative activity to those found in the second swabbing, but which was less strongly hæmolytic and did not kill mice.

I am inclined to think that both these later strains were possibly the original organism, which had not been able to maintain its characteristic features in the unfavourable environment afforded by a healthy

vagina. In this patient there was slight morbidity, immediately relieved by promotion of free drainage, but not severe sepsis, although the other favouring factors of instrumental labour and lacerations were present.

It has been demonstrated, however, particularly by Lockhart and Armstrong and Burt-White, that there is a definitely higher morbidity rate as regards mild *post partum* pyrexia in patients who harbour non-hæmolytic streptococci *ante partum*, particularly when the additional factors of manipulations or laceration during labour are present. Lockhart has disregarded all organisms except streptococci, but my own figures, though small, suggest rather that it is the presence of any profuse mixed flora, which often includes non-hæmolytic streptococci, that influences the puerperal morbidity rate (chiefly by accumulating a large amount of growth products, as described above) rather than the non-hæmolytic streptococci alone.

My figures also tend to confirm the teaching of Döderlein and others, that the vaginal bacillus is the most normal and usually the sole inhabitant of the vagina in pregnancy, and that, generally speaking, its presence is associated with a more healthy condition of the passage than that of other organisms. The actual figures on which I base this statement are: Seventy-five patients harboured vaginal bacilli alone or greatly predominating, and of these 5·3% had febrile puerperia; 28 harboured a mixture of other organisms, and of these 14·3% were febrile. A similar correlation was also noted by Houlton and some German authors whom she quotes.

The above findings, I think, definitely favour the conclusion that the organisms present in the vagina *ante partum* (even potentially pathogenic forms not usually present, except possibly when introduced within the last few days before labour) are not responsible for streptococcal puerperal fever, but in contrast there are in the literature already, and recent work is continually adding to their number, several well authenticated cases in which severe puerperal sepsis due to hæmolytic streptococci has been shown to develop when the patient either harboured these organisms herself extragenitally or was in contact with attendants or other patients who harboured them, in such situations as the throat or naso-pharynx and its accessory sinuses, an infected finger, and so on.

It would therefore seem that we must consider that the method of infection in streptococcal puerperal sepsis is the implantation of these organisms from an outside source into the genital tract during parturition, or perhaps within the few preceding days, and possibly also during the puerperium, particularly the earlier part, before lacerations and the placental site have completely healed. Theoretically one would expect implanted organisms to be most virulent in those cases in which they have been associated with a recent acute infection in the carrier, such as tonsillitis, infected finger, and so on. But, however great or slight the virulence of the organism to others, and possibly also to laboratory animals, whether infection takes place or not, seems also to depend on the resistance of the patient, a factor which appears to be of the greatest variability. Although many attempts have been made, including estimation of the bactericidal power of the blood, susceptibility to streptococcal toxins, degree of leucocytosis and so on, we have as yet no certain means of ascertaining beforehand the factor of resistance. We must therefore assume that all patients are susceptible and take all possible precautions to avoid infecting the genital canal. The practical difficulties seem almost insuperable in many respects, so that, even with the greatest care, there will probably always be a few cases, but this surely means that even greater effort should be made to eliminate infection in those in which it is possible to do so. The only way we can aim at doing this is to take the precautions which, in the light of our present knowledge, would appear to be the most effective in dealing with the known source and modes of infection. These include surgical sepsis and its adequate maintenance throughout all manipulations before or during labour and to some extent in the puerperium, the elimination of attendants and isolation of patients with any known focus of infection, and the bearing in mind always of the possibility and danger of droplet infections during any manipulations, and appropriate precautions. Antenatal care might include examination of the patient herself for possible foci of infection, and if sufficient laboratory facilities were available, an attempt might be made to reduce morbidity other than that due to hæmolytic streptococci by examination of the vaginal flora during pregnancy, and appropriate treatment if necessary. In the choice of antiseptics, especially if their introduction into the vaginal canal as a prophylactic measure is contemplated, use might be made of the knowledge that certain substances are specially potent against certain organisms, for example, brilliant green in a very weak dilution is very bactericidal towards streptococci.

PROPHYLAXIS OF PUERPERAL FEVER.[1]

By A. M. WILSON, M.D., B.S.,
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IN dealing with the causation of puerperal fever the following factors must be considered: (i) The infecting organism and its virulence, (ii) the source of the infecting organism, (iii) the site of entry of the infecting organism, (iv) the patient's resistance to the infecting organism. The infecting organism and its virulence have already been discussed by Dr. Lucy Bryce.

The Source of the Infecting Organism.

The sources of infection may be classified as follows:

[1] Read at a meeting of the Victorian Branch of the British Medical Association on July 1, 1931.

1. *Heterogenous* (that is, introduced at the time of the confinement): (*a*) Extrinsic (by the hands or instruments of the attendants), (*b*) intrinsic (by the upward conveyance of bacteria from the vulva and lower part of the vagina).

2. *Autogenous* (already present in the maternal system).

Gonococcal infections are always autogenous. Occasionally an infection may start from an old chronic tubal infection which has been disturbed by the rapid alteration in size of the uterus after the expulsion of the child and the placenta.

It is very difficult to estimate the importance of septic foci elsewhere in the body in the causation of puerperal sepsis.

Prevention of puerperal infection at its source is one of the most important prophylactic considerations.

1. The attendants should not be carriers of infection. As an example of an extreme case may be quoted that of Dr. Rutter, of Philadelphia (mentioned in De Lee's "Text-Book of Obstetrics"). He had thirty to forty cases of puerperal sepsis in a year with a high percentage of deaths. On medical examination he was found to have an atrophic rhinitis, from which virulent streptococci were cultured.

In the Women's Hospital, Melbourne, a few years ago all of the patients on one side of a ward, who were attended by the one nurse, became infected. She was found to have a discharging ear. After her removal no more cases were reported in the ward.

2. The attendants should not be transferrers of infection. Morris, in his treatise, quotes figures to prove that the incidence of puerperal morbidity is higher in the practice of those doctors doing general work, in which the incidence of septic (non-puerperal) infections is high. In hospital each obstetric patient should have her own utensils, It is surprising how, in quite good hospitals, the indiscriminate use of bedpans is allowed. Should infection occur in a hospital, the patient and her nurse should be at once isolated.

3. The patient should be confined in a "safe" place. De Lee quoted a series of statistics to show that puerperal morbidity is less in good private homes than in good obstetric hospitals, in which in turn the figures are better than in good general hospitals. As a consultant, my opinion coincides with this view. I see relatively very few cases of puerperal sepsis in private homes. From the above it must not be thought that I am advocating that all patients should be attended in their own homes, the view being discussed purely from the point of view of puerperal sepsis. However, I have always mentioned that the most dangerous of all places for a woman to be confined is in an inferior obstetric hospital.

4. To combat the possibility of intrinsic heterogenous infection the following measures may be adopted:

All manipulation and examinations must be reduced to a minimum.

In the application of forceps before the cervix is fully dilated or even before the cervix is fully pulled up over the fœtal head, it must be remembered that the blades are inserted into the uterine cavity, so that infection, if introduced, is at once placed inside the uterus.

With regard to methods of disinfection of the vulva and vaginal orifice, it was found at the Women's Hospital, Melbourne, that the simple method of cleaning with ether soap followed by the application of iodine was much safer than the more drastic methods in which the patient's external genitalia were thoroughly scrubbed with brush and then swabbed with lysol, biniodide of mercury or other antiseptic solutions.

The attitude of the obstetrician towards the treatment of sources of the possible autogenous infections is somewhat difficult to define. Teeth, tonsils, sinuses *et cetera* are given various places of importance by different obstetricians. It is advisable at any rate to investigate and remove as far as possible any gross infective foci. In my opinion, autogenous infections play a small part in the causation of puerperal sepsis.

The Site of Entry of the Infecting Organism.

Infection may be heterogenous or autogenous.

Heterogenous infections originate at the placental site by laceration of the cervix, by laceration of the vagina or perineum.

Autogenous infections originate at various sites.

With regard to the site of entry of the heterogenous organism, the placental site offers the greatest possibilities, owing to its large area and irregular surfaces with exposed thrombosed venous sinuses.

Once more must be stressed the advisability of limiting intrauterine manipulation and traumatism of the maternal soft parts.

A piece of placenta left behind in the uterus forms an efficient pabulum for the growth of organisms at the most likely site of entry. It is therefore most important that the third stage of labour should be managed correctly to minimize the risk of this happening. If the obstetrician is reasonably certain that even a small piece of placenta (say one inch in diameter) has been left behind, I think the uterus should be manually explored at once.

The Resistance of the Patient.

The resistance of the patient is affected by the general condition of the patient, the character of the labour and by traumatic lesions.

General Condition of the Patient.

The value of the general constitutional condition of the patient at her confinement cannot be overestimated. She should commence her labour in good mental and physical condition, and efficient antenatal care should be directed towards her achieving this end. Labour is an ordeal, and the patient should have gone into training to fit her for it. By exercise and rational mode of life she should be in

good physical health. Toxæmias, which undoubtedly predispose towards sepsis, should be guarded against. Any constitutional condition must be treated and remedied as far as possible.

Various therapeutic medicinal measures have been suggested with the idea of increasing the patient's resistance. I very frequently give some calcium preparation to my patients during the last three months of pregnancy and often a small dose of quinine, 0·09 gramme (one and a half grains), every day during the last month.

The Character of the Labour.

Here I should like to make a plea for the rational treatment of the ordinary case—a minimum of interference and exposure, and a maximum of care and attention. I have seen many cases of *post partum* hæmorrhage as a consultant, and many of these patients were suffering as much from shock and exposure as from loss of blood.

The management of the third stage is very important for the well-being of the patient. Loss of blood must be minimized.

Any missing piece of placenta must be sought for. To leave behind a small piece of placenta is much more serious than to leave behind a large part of the membranes. If the placenta is adherent and a manual removal is necessary, it is important not to wait until the patient is *in extremis* before performing this operation.

One frequently sees cases in which infection has occurred and in which the labour has been very easy, yet the patient who has had a long difficult labour is much more likely to be affected. Demmin, in a long series of cases, has collected statistics which show that the morbidity rate gradually increases from 0·8% for patients 12 hours in labour up to 11·25% for patients 120 hours in labour.

It therefore behoves the obstetrician to secure for his patient as easy and as short a labour as possible. The length of the labour is dependent not only on the patient's mental and physical condition, but also on the position and presentation of the child, and antenatal care should be directed towards these favourable conditions.

Traumatic Lesions.

The labour should be conducted as far as possible to minimize the presence of traumatic lesions, because not only do they provide a site of entry, but also the devitalized tissue provides a pabulum for the growth of organisms.

The resistance of the patient must be attended to during the puerperium also. Good food, sleep, rest, congenial surroundings, efficient nursing, all play important parts. The promotion of efficient drainage by postural treatment, and the prevention of retention of lochia in an early retroverted uterus are important factors.

Finally, the importance of prophylaxis in the treatment of puerperal sepsis cannot be overestimated, as the curative treatment of the well-established condition is in many cases of little avail.

PUERPERAL SEPSIS: THE DIAGNOSIS AND TREATMENT.[1]

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APPROXIMATELY one woman in five hundred dies from puerperal sepsis following on child-birth. Professor Marshall Allan,(1) in his recent report on maternal mortality and morbidity in the State of Victoria, Australia, showed that puerperal infection was the most important cause of death following on child-birth, and moreover, that the death rate from this infection was increasing, especially in Melbourne.

TABLE I.

Maternal Mortality per Thousand Live Births.

Period.	Mortality from Puerperal Sepsis.	Mortality from Other Causes.	Total.
1901-1910	1·7	3·7	5·4
1911-1920	1·5	2·7	4·2
1921-1929	1·8	3·4	5·2

In the State of Victoria for the ten years 1918 to 1927, 1,550 women died as the result of pregnancy and child-birth, 723 of these deaths being due to puerperal infection. So that we see that sepsis is the cause of nearly 50% of the deaths associated with pregnancy. Every year there are admitted into the Women's Hospital, Melbourne, approximately one hundred patients suffering from puerperal sepsis and a further three hundred with abortion sepsis. Consequently this disease forms an important part of our work there, and the definite morbidity, in association with the high mortality among patients suffering from acute sepsis, makes a deep and a sad impression upon one.

Just four years ago I had the honour to introduce this subject(2) for discussion at a similar meeting here. Tonight my part is to bring forward the question of diagnosis and treatment.

Puerperal sepsis, or, better still, puerperal infection, is a general term which includes all the conditions originating from infection of the genital tract during labour or the puerperium. In other words, puerperal sepsis is an infectious wound disease of which the bacteriology and pathology are similar to those of surgical infections occurring elsewhere in the body.

Clinical Types of Puerperal Infection.

The clinical types of puerperal infection may be classified as local or general.

Local Infection.

The following are the forms of local infection most commonly met with, namely, vulvitis and vaginitis; cervicitis and endometritis, which commonly precede parametritis (pelvic cellulitis) and peritonitis, either pelvic or general; uterine thrombo-phlebitis and *phlegmasia alba dolens*. In these types the infecting organism gives rise to a local inflammation in the genital canal and the areas surrounding it.

[1] Read at a meeting of the Victorian Branch of the British Medical Association on July 1, 1931.

General Infection.

General types of infection are manifest as septicæmia or, better, bacteriæmia, and pyæmia. When the infection is due to a virulent hæmolytic streptococcus or staphylococcus, the local lesion may be comparatively slight; the infection rapidly breaks through all of Nature's defences and barriers, and spreads by means of the lymphatics and veins past the uterus until it reaches the general blood stream, thus causing a general systemic infection.

Sapræmia.

Sapræmia is the term universally used for a toxæmia that not uncommonly occurs early in the puerperium associated with fever and a profuse, heavy lochia. The vaginal flora usually spreads up into the uterine cavity a few hours after parturition;[3] if there be much foreign material, such as blood clot, left behind in the uterus, these organisms may flourish and cause an intense toxæmia. But the condition is really a mild endometritis, with only superficial tissue invasion in association with a severe toxæmia. Such a type of infection is always potentially dangerous.

Diagnosis of Puerperal Infection.

It is wise to regard every rise of temperature occurring in the puerperium as due to puerperal infection until it has been demonstrated that some other satisfactory cause is responsible. Mastitis and pyelitis can give rise to fever early in the puerperium; the former can be detected by examination of the breasts and the latter by examination of a catheter specimen of urine. If a patient who has been doing well after delivery, has a rise of temperature on the third or fourth day exceeding 38° C. (100·4° F.) which persists for more than twenty-four hours, it is practically certain that there is an infection, particularly if there be an initial rigor.[4] The next points to be considered are: (*a*) Is there anything in the uterine cavity? (*b*) Is the infection local or general? (*c*) What is the causative organism?

Sapræmia.

In the first instance, on abdominal palpation the uterus is felt to be tender and high and not properly involuting; the lochia is profuse, heavy and dark red, indicating the so-called condition of sapræmia. The history will probably show that the third stage of labour was not perfect and that the membranes were ragged and the placenta was incomplete.

Local Infection.

On the other hand, the history of the labour should indicate the site of the infection. For example, if the delivery were instrumental, with extensive injury to the cervix, the usual result of infection would be a cervicitis followed by pelvic cellulitis or pelvic peritonitis, which is recognized by lower abdominal tenderness, distension and pain. The patient looks ill, but not desperately ill; with a rise in temperature, tenderness of the uterus and a purulent lochia, the diagnosis of local sepsis may be made.

General Infection.

But if the infection has invaded the blood stream, then the patient looks very ill indeed. Usually the onset of the illness occurs about the second or third day with a severe rigor lasting from five to twenty minutes. The temperature rises rapidly to 39·4° or 41° C. (103° or 106° F.) and the pulse rate to one hundred and twenty or more per minute. Symptoms of a rapidly spreading general peritonitis may supervene with nausea, vomiting, abdominal pain, distension and rigidity. The lochia may be profuse and heavy, but usually it is scanty and without odour. The patient with a fulminating type of infection may die within thirty-six to forty-eight hours of delivery. If the patient is able to overcome the attack, the symptoms become milder and a general improvement is noticed, with greater remissions in the temperature and a lower pulse rate. The patient may further drift into a subacute or chronic state of pyæmia, with the formation of metastatic abscesses in various organs and parts of the body. If, on attempted blood culture, organisms are grown freely, it is certain that bacteriæmia is present, but the severity of the illness is a good guide. A continuously high temperature, a very rapid pulse and severe prostration point to a bacteriæmia.

Bacteriological Examination of the Blood and Lochia.

A blood culture should be attempted if the patient is seriously ill. If "positive," the report should state how many microbes there are per cubic centimetre of blood; the presence of a few only will suggest a good prognosis. The lochia is examined by taking a swabbing from the cervix. Usually in severe local sepsis hæmolytic streptococci are found in pure culture locally or in predominating numbers. A vaginal examination should be avoided unless a collection of pus is suspected in pelvic cellulitis or pelvic peritonitis.

Treatment.

Prophylactic Treatment.

In considering the treatment of puerperal sepsis prophylaxis should occupy the most important place. As De Lee[5] points out, so much can be done by prevention and so little by treatment that our efforts must continue to be concentrated on asepsis and on a physiological conduct of labour. By preventing exhaustion and loss of blood a great deal is accomplished in the prevention of infection. Indeed, it can be said that puerperal sepsis depends upon tissue damage and hæmorrhage.

We realize that puerperal sepsis is a wound infection due in most cases to pyogenic organisms being introduced into the genital canal from without by some means or other. It has been shown by Lucy Bryce[6] and numerous other workers[7] [8] [9] that such pathogenic organisms are uncommon in the genital tract until severe local disease has occurred. On the other hand, numerous non-pathogenic organisms are present normally in the vagina, and these do occasionally give rise to mild local sepsis by an autogenous infection.

The Use of Antiseptics. Assuming that severe puerperal infection is mainly exogenous, the question is whether treatment of the vulva and vagina with an efficient germicide will or will not destroy the virulent hæmolytic streptococci which may gain entry into the birth canal during parturition. Lysol is used very generally as an antiseptic in midwifery, and is the medical practitioner's great safeguard. But Garrod[10] has shown that it is the most caustic of antiseptics in general use, and the limitations thus imposed on the strength of the solution bring such a weakened solution dangerously near to a point at which it is ineffective as a germicide. He tested fifteen germicides used in obstetrics, the test organism being *Streptococcus pyogenes*. Lysol was found to be ineffective if diluted until it was not actually caustic. Brilliant green was by far the most potent and best germicide. Cyllin and allied coal tar products were good; cyllin has been used at the Women's Hospital for many years. It is less poisonous than lysol and less irritating to the skin, despite its much greater efficiency, and therefore it is to be recommended.

Vaginal Examination. It has long been recognized that the morbidity rate is increased in every large maternity hospital where vaginal examinations are made during labour for teaching and other purposes. This is not entirely due to the introduction of organisms from outside, but is probably caused by the finger moving infected material from a comparatively safe position in the vagina to a dangerous position in the cervix. Claye[11] has shown that when patients are delivered normally and without vaginal examination the morbidity is reduced by half. Professor Windeyer[12] recently demonstrated to us here how abdominal examination could almost entirely replace vaginal examination.

Droplet Infection and Face Masks. The Aberdeen report upon puerperal infection has again drawn attention to the possibility of infection by mouth "spray." John Smith[13] proved that in twelve among twenty-one patients with severe puerperal sepsis the infecting organism was a hæmolytic streptococcus, which was traced to the nose or throat of one of the attendants, nurse, doctor or student. Recently here, Marshall Allan and Lucy Bryce[14] found that in a patient admitted into our wards with septicæmia, the nurse in attendance outside was a "carrier" of the infecting organism, the hæmolytic streptococcus. This was important, because an action for damages was threatened against the doctor. Therefore face masks should be worn by the attendants at a confinement, as at a surgical operation, and our hospitals should set the example for general practice.

The Prophylactic Douche. In view of the practical unimportance of autoinfection, vaginal douches before and during labour should not be given. Indeed, the advocates of such douches found that their morbidity rate was actually increased thereby. Recently in America I saw mercurochrome solution being sprayed several times a day into the vagina during labour and in the puerperium without, as far as present reports go, any appreciable benefit.

Curative Treatment by Non-Interference. The treatment of puerperal pyrexia may be summed up in the word non-interference. Moreover, good nursing, fresh air and sunshine, and a generous diet and postural treatment to drain the uterus naturally will largely help in every case. R. H. Morrison, of Melbourne, was one of the first to advocate many years ago such a policy of rational conservatism, and this policy has been maintained at the Women's Hospital.

The Leucocytic Barrier. The whole parturient canal can be regarded as a wounded surface after delivery. Under the necrosing decidua a definite leucocytosis occurs, the so-called leucocytic barrier; this barrier, together with the antibodies brought by the blood and distributed through the tissues by the serum and lymph, forms Nature's great defence against bacterial invasion.

The Bactericidal Power of the Blood During Pregnancy. So much investigation has been carried out in the past upon the invading organisms, the "seed," that the work of Miller and Whitaker,[15] of the Edinburgh Royal Maternity Hospital, upon the body defences, the "soil," is both interesting and valuable. They have demonstrated that the bactericidal power of the blood, reaching its maximum at child-birth, is higher in pregnant than in non-pregnant women, and that this is not entirely due to an increased leucocytosis. If bactericidal activity is low, a morbid puerperium may often result. Miller and Whitaker found that in severe and difficult labour, complicated by trauma and potentially septic, the majority of patients with a bactericidal power above the average recovered, often without the intervention of sepsis; the lesser number, with a bactericidal power below the average, either became severely septic or died of the infection. This, of course, confirms what we know happens clinically. Therefore in treatment we have to consider the "soil," that is, the tissues of the body and the blood and their power to resist the "seed" sown during an infection. Our great endeavour is to try to raise local tissue resistance and to increase the general bactericidal power of the blood.

Local Treatment.

Irrigation and disinfection of the uterine cavity in puerperal sepsis are inefficient, because the invading organisms are out of reach within a few minutes. Fleming[16] has demonstrated that any familiar antiseptic strong enough to kill organisms impairs or absolutely inhibits the bactericidal functions of the blood, particularly that of the leucocytes; therefore, the chief action of antiseptics within the cavity of the uterus is to paralyse the defending leucocytes. I know that it is so tempting to be "doing something" in cases of acute sepsis, but often the uterus is macroscopically quite clean and empty, with the infection long ago out of reach within its tissues or even further afield. In a case of sapræmia, often with a bulky uterus and a heavy,

ILLUSTRATIONS TO THE ARTICLE BY MR. G. V. RUDD.

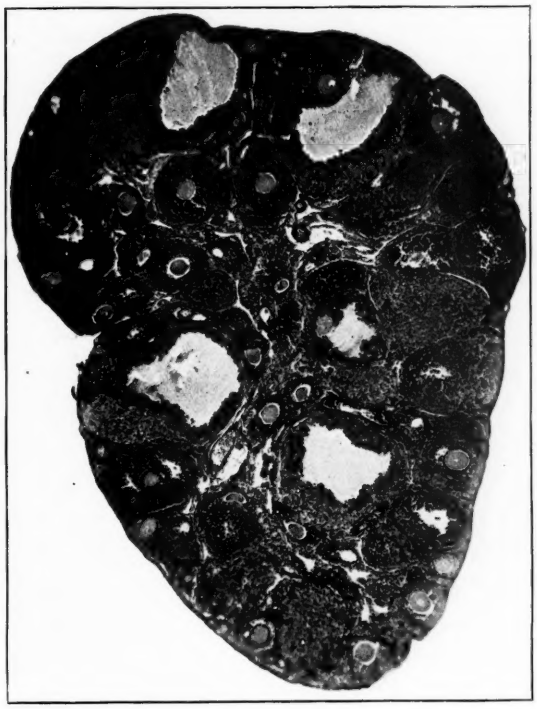

FIGURE I.

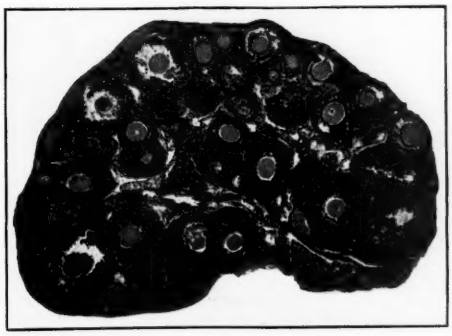

FIGURE II.

ILLUSTRATIONS TO THE ARTICLE BY DR. KARL EHRHARDT AND DR. BRUCE T. MAYES.

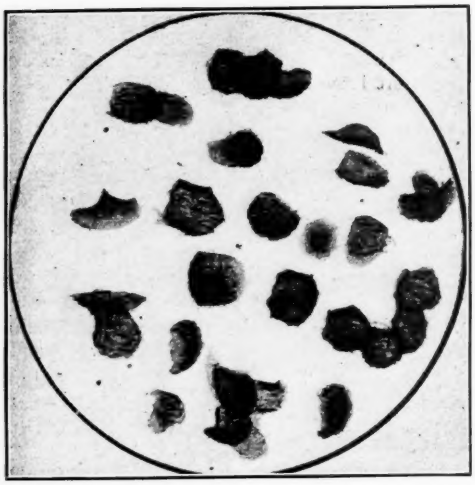

FIGURE I.
Vaginal smear from a mouse during œstrus. Large cornified "*Schollen*" cells.[1]

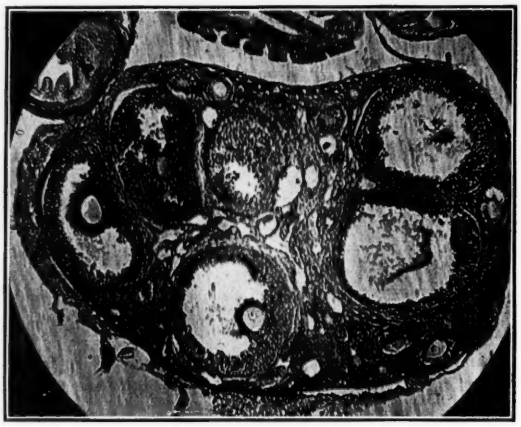

FIGURE III.
Ovary of mouse showing ripe Graafian follicles (Reaction I).

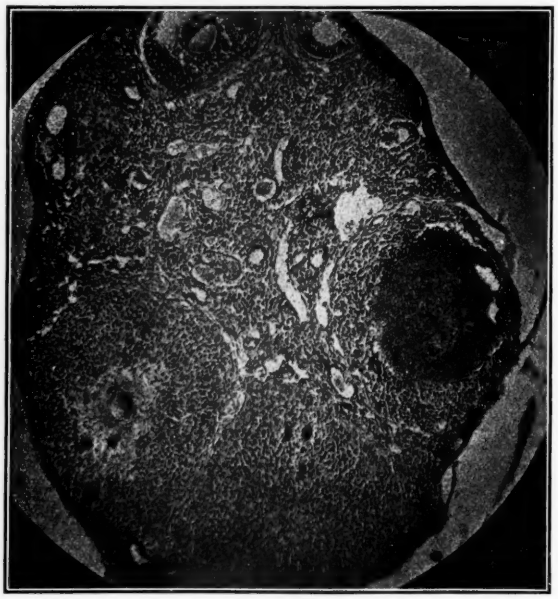

FIGURE IV.
Ovary of mouse showing one blood point (blood filled follicle) —Reaction II—and two *corpora lutea*—Reaction III.

[1] The figures in this article were prepared in the laboratory of the Universitäts-Frauenklinik, Frankfurt am Main.

profuse lochia, it does seem tempting to give an intrauterine saline solution douche in the hope of washing out fragments of placenta and membranes and blood clot which are foreign material harbouring saprophytes and even pathogenic organisms mainly living a saprophytic existence. But there is always the risk of carrying infection higher up the parturient canal, even into the peritoneal cavity; protective blood clots, closing the uterine sinuses, may also be dislodged. But such a patient with sapræmia gets better, and quickly too, if left alone. Place her in a low Fowler's position with frequent turning about in bed in order to drain the uterus, which is also stimulated to contract and involute by the oral administration of quinine, ergot and strychnine.

At the Women's Hospital, Melbourne, there are nearly four thousand child-births *per annum*, with an average morbidity rate, according to the British Medical Association standard, of less than 4%. Patients with pyrexia are treated entirely along conservative lines, and in 1926 only three became affected by septicæmia and yielded organisms on blood cultures; two of them recovered. A sick woman, particularly with a torn perineum, resents any manipulation, even an intrauterine douche. Therefore, if such interference does little or no good, but possibly harm, let her alone.

Swabbing out the uterus, curage or digital removal and curettage are other methods of local treatment in puerperal pyrexia which are liable to produce harmful and even disastrous results. I have seen many innocent sapræmic and mild septic conditions from which the patients would have quickly recovered if only left alone, converted into acute local sepsis, such as pelvic cellulitis or peritonitis with weeks or months of serious illness, or even lighted up into a septicæmia with a rapidly fatal ending. Therefore, exploration of the uterus can be a dangerous procedure and should not be done except for hæmorrhage.

In puerperal pyrexia with free hæmorrhage give local stimulatory treatment, that is, quinine, ergot and strychnine by mouth and extract of pituitary gland by hypodermic injection; if this be ineffective, then explore the *cavum uteri* with the finger and, if necessary, pack the uterus.

Intrauterine Glycerine Treatment. Remington Hobbs[17][18] has recently restored a method which I am informed was in vogue here many years ago. By means of a number eight rubber catheter, fifty-seven cubic centimetres (two ounces) of unsterilized glycerine are syringed once or twice a day under low pressure over the interior of the uterine cavity. Glycerine acts by reason of its hygroscopic effect, causing a flow of lymph from the inflamed endometrium, relieving blood stasis and stimulating phagocytosis. Moreover, by stimulating muscle contraction, glycerine also helps the uterus to expel any retained foreign material as infected blood clot. This treatment is certainly useful in the few cases of sapræmia which do not respond in two or three days to the usual conservative treatment. It also helps to clear up quickly the purulent lochia in endometritis.

Local Treatment with Antivirus. Besredka,[19] of the Pasteur Institute, has introduced an antivirus which is essentially an old filtered bouillon culture of the organisms to which it is specific. I have soaked gauze in streptococcal antivirus supplied by the "Glaxo" Company and passed this into the uterine cavity in a few cases of endometritis with a purulent lochia and the discharge rapidly cleared up. At present I feel that its use is limited, because such treatment will rarely be necessary when the infection is limited to the uterus, whereas it will rarely be effective when the process has extended beyond that organ. In a badly torn and infected perineum and vagina it may prove very helpful.

General Treatment.

In discussing the subject of general treatment, I always place good nursing, good food and fresh air and sunshine as the most important factors in the treatment of puerperal sepsis. It is always a source of amazement to me to see many very sick patients, who have entered the hospital from unsuitable surroundings, respond so quickly to good nursing and proper hygiene.

Vitamins A and D. The use of vitamin *A* as an anti-infective agent was demonstrated by Mellanby and Green in the laboratory. Later the use of massive doses of vitamin *A* in the treatment of puerperal septicæmia was carried out by them[20] with apparent success. It has also been shown that vitamin *D* raises the bactericidal power of the blood, chiefly by creating an adequate concentration of calcium in the serum. "Radiostoleum" and "Adexolin," a product of the "Glaxo" Company, contain vitamin *A* and *D* in concentration and may be usefully given in severe infection, as well as food which includes egg yolk and green vegetables, with butter and cheese.

Having attended to the general hygiene of the patient, our next concern is whether we are dealing with a local or a generalized infection.

Local Sepsis. The fact that the infection is becoming localized shows that the woman has some resisting power, which in the end will overcome the bacterial invasion. The prognosis is good, for most patients with local infections, however severe, recover. Often the uterus is unduly large and involution is delayed; therefore ergot is given orally and pituitary extract hypodermically to stimulate contraction and involution and so bring about such occlusion of the lymphatics and veins as may possibly prevent the extension of bacteria through the uterine wall. Apart from their local and general tonic effect, these drugs also stimulate the reticulo-endothelial system and the bone marrow and thus stir up the blood-forming centres to greater efforts and so prevent a local infection from becoming generalized.

"Antiphlogistine" applied to the abdomen and hot vaginal douches, after the tenth day *post partum*,

give great comfort and help to the patient. Collections of pus must be located and drained by posterior colpotomy or extraperitoneally by an incision through the abdominal wall above Poupart's ligament.

General Sepsis. In septicæmia the infection has become general because the invading organism is virulent and the body resistance low. Here general treatment may be undertaken by immunological methods, which aim at increasing the patient's natural powers of resistance by active or vaccine therapy or by passive or serum therapy and blood transfusion.

Vaccines. In local sepsis, autogenous vaccines may do good and I have found them useful in protracted chronic cases. In septicæmia, vaccines in my experience are useless. Vaccine therapy in acute sepsis has long been in favour in London, but Armstrong and Shaw[21] recently demonstrated that its usefulness is either indefinite or non-existent in treatment, and supported this by laboratory experiment.

Serum. In severe local sepsis and septicæmia the condition of the patient calls for immediate help in the form of serum, well loaded with antibodies and antitoxins. In severe sepsis we have given normal horse serum, anti-diphtheritic serum, post-influenzal serum and for many years large amounts of puerperal polyvalent antistreptococcal serum, prepared at the Commonwealth Serum Laboratories, both intravenously and intramuscularly without apparent effect. For years we have used this serum as a prophylactic measure in the Women's Hospital in all obstetric cases requiring much manipulation and as a therapeutic measure in early pyrexia. Parish and Okell,[22] however, have shown that concentrated scarlet fever antitoxin does afford better protection against puerperal infection and it is reported to be a satisfactory therapeutic agent.

A great deal of investigation has been done recently in regard to the relationship of the Dick test to puerperal sepsis.[23][24][25] But the incidence of puerperal sepsis is so dependent on the general health of the patient and upon the type of delivery, that any reliance on the Dick test as an indicator of liability to sepsis would not be justifiable. At the same time, an attempt to produce a temporary immunity with a concentrated antiscarlet serum in all suspected cases at the time of delivery might reduce the incidence of puerperal sepsis.

Blood Transfusion. Septicæmia due to hæmolytic streptococci may be regarded as a disease of the leucocytes, because their phagocytic function becomes more and more depressed as the disease progresses; therefore the situation is indeed a desperate one, because on the one hand there is a very large infection and on the other the patient's normal mechanism for dealing with it is almost out of action. Consequently blood transfusion gives immediate and necessary help to the desperately ill woman and stimulates her own blood-forming organs to fresh efforts. Five hundred and sixty-eight cubic centimetres (one pint) of citrated blood can be given at once and smaller transfusions may be repeated two or three times during the next few days. I have frequently tried immuno-transfusion, but I have not found it any more effective than the ordinary transfusion.

Blood Chemical Therapy. A reliable drug for intravenous use in the treatment of severe sepsis has not yet been found. Perchloride of mercury, formalin and iodine fail as antiseptics in the blood because they combine with the serum proteins, whilst others, as carbolic acid, quinine and flavine, combine with and destroy the cells of the blood. Fleming showed that flavine killed the ordinary pyogenic microbe, but that the destructive effect on the leucocytes was ten times as great.

Five years ago I gave mercurochrome a thorough trial and, though the results were both helpful and interesting, I soon realized that any immunity gained was more from protein shock than from any germicidal action in the blood. Therefore it seemed too potent a drug to give for protein shock therapy, which is achieved easily and safely by intramuscular injections of vaccine or of sterilized milk.

Arsenical Compounds. Colebrook[26] has noticed that after the administration of "Neosalvarsan" and similar compounds the blood serum of the patient has and retains for usually twenty-four hours a largely increased power to kill hæmolytic streptococci. A dose of 0·6 gramme of "Novarsenobillon" may be given intravenously; for many years I have injected "Sulpharsenol," 0·6 gramme, intramuscularly every day or twice a day for six doses in acute sepsis.

Operative Treatment.

I have already mentioned above that any abscess formation must be located and suitably drained.

General Peritonitis. For years I have regarded streptococcal general peritonitis as being invariably fatal. Recently I have had three desperately ill women recover after drainage of the abdominal cavity through a small mid-line incision, made under local anæsthesia, with a small stab drainage wound in either flank. Hæmolytic streptococci were recovered from the pus.

Pelvic Peritonitis. Pelvic peritonitis is best treated conservatively, and no surgical procedure should be attempted that would risk breaking down Nature's adhesions protecting the upper part of the abdomen from the infected area. If an abscess is located, every effort should be made to drain it by posterior colpotomy.

Thrombo-Phlebitis. Prompt cure sometimes follows early ligation of the thrombosed vessels, namely, the ovarian veins and such veins in the broad ligament as can be reached. But this is a very serious operation for a patient dangerously ill with pyæmia, of which I have had no experience and for which I have no inclination.

Hysterectomy. By radical removal of the septic focus, that is to say, the uterus, one might hopefully

rid the patient of her infection. But apart from the great difficulty of deciding upon the proper cases for operation, the results of hysterectomy are very bad.

In conclusion, may I again emphasize that in the treatment of puerperal infection prophylaxis should occupy the most important place. So much can be done by prevention and so little by treatment that our efforts must continue to be concentrated on asepsis and on a physiological conduct of labour.

Conservatism and reliance upon Nature's own powers of healing are the guiding principles of treatment.

Summary.

1. Prevention must occupy the most important place in the treatment of puerperal sepsis.

2. Vaginal examination can almost entirely be replaced by abdominal examination.

3. The type of antiseptic in common use in midwifery must be reviewed. Cyllin and brilliant green are advocated.

4. In view of the risk of "droplet" infection, face masks should be worn by all attendants at confinements.

5. Non-interference is the safest method of dealing with the uterus in puerperal sapræmia and sepsis.

6. In the few cases in which such conservatism is not proving satisfactory, intrauterine glycerine therapy may be usefully instituted.

7. Early diagnosis of sepsis is important, so that suitable nursing and treatment can be given early.

8. Food containing vitamins *A* and *D* should be given, and also "Radiostoleum" or "Adexolin," which contain these vitamins in concentration.

9. Vaccines appear to be helpful only in protracted chronic cases.

10. Antistreptococcal serum should be used as a prophylactic measure in all suspected cases and as a therapeutic measure in early pyrexia. But in established sepsis, particularly in acute cases, this serum has given no apparent clinical help.

11. Blood transfusion gives immediate and valuable aid in acute sepsis.

12. "Novarsenobillon" and similar arsenical compounds appear to have some specific effect upon hæmolytic streptococci; the use of arsenical compounds is therefore indicated in acute sepsis.

13. Apart from suitable drainage of any abscess formation in pelvic cellulitis and pelvic peritonitis and in general peritonitis, surgical treatment is not advocated.

Acknowledgement.

I should like to express my grateful thanks to the resident medical officers and the nurses who work so hard for and are largely instrumental in the recovery of women suffering from acute puerperal infection.

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THE PHYSIOLOGY AND PATHOLOGY OF THE OVARY AND GENITAL TRACT.

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AFTER years of intensive research by an army of workers we are entitled to feel that some definite information has been collected concerning the ovarian and uterine cycle.

Adler,(1) who with Hitschmann first demonstrated the endometrial changes during the menstrual cycle, gave an impetus to the study of ovarian changes. The cycle appears to depend upon the anterior lobe of the pituitary gland for the first stimulus,(2) and Zondek(3) has shown that this lobe has two secretions, one influencing growth and the other influencing the sex complex. Subsequently Zondek(4) has demonstrated that the sex hormone has two elements: (i) that which effects the ripening of the follicle, and (ii) that which effects the luteinization.

The element which stimulates the ripening of the follicle appears on the atrophy of the *corpus luteum*, that is, during menstruation, and it produces ovarian engorgement and stimulates the ovary to secrete the follicular hormone and to ripen the ovum. By about the tenth day after the onset of the last menstruation, the luteinizing element of the anterior hypophysis becomes active and luteal cells begin to appear in the *theca externa* of the follicle, and at the same time the luteal hormone stimulates the endometrium to prepare for the embedding of the ovum.

The luteinizing element does not become effective, however, until the ovum reaches a certain stage, while the death of the ovum, which occurs at about the twenty-fourth day if it is not fertilized, means that this element is no longer produced.

About the fifteenth day the follicle ruptures as a result of internal tension of the *liquor folliculi*, and possibly also from the effect of pituitrin, according to Marshall and Runciman.[5] The follicle immediately fills with blood clot, which becomes organized into luteal tissue, and so the *corpus luteum* forms.

If the follicle does not ripen, the luteinizing element of the anterior hypophysis is not brought into effect and the endometrium remains thin, as in a post-menstrual state. It would seem very unreasonable, then, that bleeding from the uterus should occur, as stated by Hemsley[6] if "there is no formation of Graafian follicles." Hemsley states that "the bleeding in these cases may be copious and is always irregular and sustained." It is rather difficult to see why this should occur, and one would suspect in these cases some morbid endometrial condition or placental polypus, but never a lack of ripening Graafian follicles.

A number of cases of radiation of the ovaries by X rays have been seen both in the human female and in animals. The ripening of the Graafian follicles has been stopped, but these bleedings have never occurred as a result.

The anterior hypophyseal hormones produce an engorgement of the entire genital tract, and the luteal hormone adds to this engorgement, so that uterus, tubes and cervix are relatively congested.

There does not appear to be any oxytocic principle in the cerebro-spinal fluid of human females according to the records of Shapiro,[7] who examined the cerebro-spinal fluid of twenty-five women; but there is definitely what Zondek terms "prolan," the hypophyseal extract, at certain phases of menstruation.[8] [9]

The amount of the ovarian hormone in the blood also varies. Using the method of Sidalls,[10] we tested the blood of one hundred and twenty patients and found that the effect of this blood upon the genitalia of rats was completely in accordance with the cyclic change and that the variation followed fairly closely the variations of blood calcium (Matters[11]) during the menstrual cycle, and also the changes in the basal metabolic rate.[12]

It has already been stated that if the ovum remains unfertilized at the twenty-fourth day, it dies, and when this occurs the anterior luteinizing hormone no longer is active. The *corpus luteum* atrophies, and so by the twenty-eighth day the endometrium is cast off and the blood sinuses are empty, and thus menstruation results.

Except for necrotic endometrial areas or where placental polypi occur and are very adherent, the endometrium is changed each month, so that infective processes do not have much scope in the uterine cavity. To the cervix, however, this does not apply; the congestion each month stimulates the glandular tissue and the glands of the endocervix, which are tall columnar glands with basal nuclei, respond to the congested conditions. If, therefore, a Neisserian infection has been present, or if a cervical laceration has occurred as a legacy of parturition and is, as in all cases, subsequently infected, then the invading organisms have an opportunity to establish themselves during the post-menstrual phase and to spread in the cervical lymphatics. These organisms act as irritants and stimulate the endocervical tissue so that it grows luxuriantly and spreads over the *portio vaginæ* with resulting erosion. Meanwhile the infecting organisms stimulate the formation of fibrous tissue in the utero-sacral ligaments and the ligaments of Mackenrodt. The result of this fibrous invasion is the limited mobility of the uterus, and this causes backache and dragging pains.

The congestion of the premenstrual phase aggravates these symptoms, and so dysmenorrhœa ensues and the engorged adenomatous tissue provides a copious discharge. Further, a compilation of investigations indicates that cervical malignant disease occurs predominantly in women who have borne children, or in *nulliparæ* who have had a cervical discharge for a long time.

The irritant effect is provided by the adenomatous tissue, but the squamous tissue is that which responds to the irritation most frequently. Cervicitis is rarely associated with trouble in the *corpus uteri*, as is considered by Hemsley, and cervical malignant disease, according to statistical records, is far more frequently of the squamous epithelioma type than adenocarcinomata. Cervicitis, especially following laceration, should be regarded as potentially malignant, as Robert Fowler, of Melbourne, has so ably stated.[13] These cases have proved to be amenable to treatment by radial linear coagulation of the *portio vaginæ* and also of the endocervix. A halo of radium needles may be formed by inserting the needles around the periphery of the cervix.[14] This treatment has been performed and has been controlled by sections taken before and also after treatment.

The clinically early types of malignant disease have given excellent results from this method of treatment. Should the condition have failed to clear up after four months and should sections show any malignant proclivities, then the radical operation of Wertheim should be performed.

Where the lacerations of parturition have allowed a low grade infection of the uterus and parametrium, then the elastic tissue is not reabsorbed and the round-celled infiltration is followed by the laying down of fibrous tissue, the end result is fibrosis, and this condition may cause menorrhagia. The past method of coping with this condition was hysterectomy, which resulted in a retardation of the ovarian activity and finally produced menopausal symptoms.

Irradiation of the uterine cavity with radium in doses of 800 to 1,000 milligramme hours, however, obviates the misery of operative procedure and provides a result which actually is superior to that of hysterectomy.

It is perhaps not out of place to conclude with a reference to what may be termed the applied physiology of the reproductive apparatus. It becomes clearer every day that the days of arbitrary surgery of gynæcological conditions are past. Insufficient knowledge of the function of the mechanism leads to surgical treatment which is not only without effect upon the condition, but also definitely undermines the patient's mental and physical health. The history of operative treatment of thyreoid disease is an apt reminder, and in thyreoid conditions the physiology is infinitely simpler than in conditions of the reproductive apparatus.

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AN EXAMINATION OF THE ASCHHEIM-ZONDEK TEST FOR PREGNANCY.

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RAPID advances in our knowledge of the female sex hormones have been made during the past few years. The production in the ovary of an œstrogenic hormone contained in the *liquor folliculi* has been fully demonstrated. This hormone, which has been called variously the female sex hormone, folliculin, œstrin and theelin, has been isolated in the crystalline form by Veler, Thayer and Doisy[1] from the urine of pregnant women. Patel[2] has prepared from bovine *corpora lutea* an œstrus-inhibiting hormone with which he was able to suspend the appearance of œstrus in mice for a considerable time. Aschheim and Zondek[3] [4] [5] have demonstrated that the injection into immature female mice of the urine of pregnant women results in changes in the ovaries and uterus, similar to those which they observed to follow the implantation in the animal of a fragment of the anterior lobe of the pituitary gland. Microscopically examined, the ovaries showed maturation of the follicles, the formation of *corpora lutea* and *corpora lutea atretica* and hæmorrhages into follicles or *corpora lutea*. Macroscopically the ovaries were two to three times enlarged, were distinctly redder than the ovary of a similar normal mouse and showed the hæmorrhages as dark spots and the *corpora lutea* as yellowish protrusions. The uterus was seen to have grown from the thread-like structure normal for mice of this age to a swollen organ, possibly hyperæmic and full of fluid. Aschheim and Zondek consider that in pregnancy there is a tremendous increase in the activity of the anterior lobe of the pituitary gland, resulting in the secretion of relatively great quantities of the anterior lobe hormone, which they have named "prolan." It is the same as the substance which in the implantation experiments with fragments of the anterior lobe in immature female mice is responsible for the ovarian and uterine changes that occur. Aschheim[5] finds that in human pregnancy it is present in the decidua, *corpus luteum*, placenta, amniotic fluid, young embryo, blood serum and urine. In the urine of pregnant women it is present in sufficiently large amounts to make unnecessary any concentration of the urine before it is administered to mice in the course of the Aschheim-Zondek pregnancy test. The technique of this test demands the use of five or six female mice not more than twenty-one days old, when their weight will be approximately six grammes. A specimen of early morning urine from the woman under investigation is obtained and five mice are injected respectively with 1·2, 1·5, 1·8, 1·8 and 2·4 cubic centimetres of the urine. Each injection is divided into six equal doses, three being given on each of two successive days. If a sixth mouse is used, it is given a 1·5 cubic centimetre injection. One hundred hours after the first dose the mice are killed with coal gas and their ovaries and uteri are examined for changes induced by the anterior lobe hormone. If doubt exists as to the nature of the reaction of the ovaries, they are cut in serial sections. By microscopical examination then three types of reaction may be distinguished:

Reaction I.—Enlargement of the follicles without hæmorrhages or the formation of *corpora lutea*.

Reaction II.—Hæmorrhages into the enlarged follicles; these are usually visible to the naked eye.

Reaction III.—Formation of *corpora lutea* and of *corpora lutea atretica*.

Reaction I is not diagnostic of pregnancy, but if it is found in all ovaries, the possibility of pregnancy is indicated and the test should be repeated with a new specimen of early morning urine. Either reaction II or reaction III is diagnostic of pregnancy. In Figure I is seen a section of an ovary showing reactions II and III, and Figure II is a section of an ovary from a mouse injected with the urine of a non-pregnant woman.

The uterus of a mouse whose ovaries show a positive reaction may vary from being somewhat enlarged, to being very swollen and full of fluid. Also it may be hyperæmic. These reactions, which are induced by œstrin, are not necessarily indications of pregnancy and indeed may sometimes be obtained, although usually in a lesser degree, in a mouse injected with the urine of a non-pregnant woman. Therefore they cannot be relied upon to decide whether or not a pregnancy exists.

Aschheim and Zondek[3] obtained a high degree of accuracy with the test, except in endocrine disorders and genital carcinomata, in which the percentage of correct results was somewhat lower. This was due to the recording of a number of false positive reactions.

Brühl,[6] using the test with fewer mice and examining all the ovaries in serial sections, concluded that the test was highly reliable. Wermbter and Schulze[7] in 109 cases obtained only two incorrect results; in one of these instances the reaction failed to occur, in the other there was a positive reaction. Eighteen women whom they examined were from five to six weeks pregnant and sixteen were from seven to eight weeks pregnant, and all these gave a positive reaction. Wagner,[8] in a comprehensive review of the results of the test, concludes that it is the most reliable of all proposed tests for pregnancy and that the results obtained are accurate in nearly 99% of cases. Allan and Dickens,[9] in an examination of the test with more than 230 specimens of urine, obtained four incorrect results when the reaction failed to occur, and one incorrect result, when the reaction was positive; and Mack[10] attained an accuracy of 98·8% in his 259 cases.

In this paper is described a series of cases to which the Aschheim-Zondek test was applied. In one of the early tests of the series all the mice died within twenty-four hours of the first injection. At this time the preservation of the specimens of early morning urine with toluene was commenced and they were stored in ice until they were required for use. It was always found convenient to keep them in ice for at least a few hours before they were needed. The specimens were prepared for injecting by filtration through a wet filter paper and were preserved with toluene during the course of the injections. Only three of 250 mice injected with urine treated in this way died during the test. The mice were used at an age of from seventeen to twenty days, when their weight was usually in the vicinity of from six to eight grammes. The details of technique described by Aschheim and Zondek, and mentioned above, were followed.

Of the total fifty-one specimens of urine examined twelve were from women whose pregnancy was normal and gave a positive reaction to the test. Two of these specimens were from women only six weeks pregnant, and the others were taken at various times during pregnancy, the last four being obtained from women at term.

Two women with ectopic pregnancy and one with eclampsia reacted positively to the test.

Ten women with incomplete or threatened abortion all gave a positive reaction. Specimens were taken from women with incomplete abortion only when the patient gave a history of having commenced to abort within the previous twenty-four hours. Of these cases the earliest pregnancy was one in which the menstrual period was only one week overdue.

Thirteen specimens of urine were obtained from women known not to be pregnant, and eleven specimens from gynæcological patients. All the mice in all the tests gave no reaction. Among the gynæcological conditions were cases of ovarian cyst, uterine fibroids, endocervicitis and carcinoma of the cervix.

Therefore, in forty-nine cases the Aschheim-Zondek test gave the correct positive reaction in twenty-five and the correct negative result in twenty-four. To obtain such a high degree of accuracy with a biological test such as the Aschheim-Zondek test is a most impressive fact in evidence of its reliability. The only discordant results were obtained in the remaining two tests, which were performed with specimens of urine obtained from two women forty-five and fifty hours respectively *post partum*. Only the ovaries of the mice injected with urine obtained fifty hours *post partum* showed a positive macroscopical reaction, and microscopical examination of the ovaries of the test animals used with the specimens taken forty-five hours *post partum* was not done. Aschheim[5] states that the reaction to the test always fails by the eighth day after delivery. The failure to obtain a reaction with urine passed forty-five hours *post partum* probably indicates a rapidly falling concentration of the hormone of the anterior lobe of the pituitary gland in the urine. Zondek and Aschheim[4] have demonstrated that even in the later months of pregnancy the quantity of the hormone in the urine is greatly reduced from the level maintained in the earlier months.

Summary.

1. The Aschheim-Zondek test for pregnancy has been described and some of the results obtained by various workers with the test have been mentioned.

2. Our series of twenty-five cases of pregnancy have given a positive reaction to the test. The earliest of these was a five weeks' pregnancy.

3. Our twenty-four specimens of urine from non-pregnant women all failed to react to the test.

4. Of two specimens of urine taken forty-five and fifty hours *post partum*, only the latter reacted positively.

Acknowledgement.

It is a pleasure to express my gratitude to Dr. E. M. Humphery for his kindness in taking the microphotographs.

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THE ANTERIOR PITUITARY HORMONE AND THE ASCHHEIM-ZONDEK PREGNANCY TEST.[1]

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THE early diagnosis of pregnancy has been sought by devious ways over a period of very many years. The idea that the urine of a pregnant woman would give an indication of her gravid state is very old and was held by the Egyptians more than three thousand years ago. The history of attempts to extract this secret from the urine is an interesting and at times an amusing one.

It is only during the past few years, however, that Aschheim and Zondek, working in Berlin, have been able to furnish us with a means to diagnosis which in its practical nature and reliability has conferred a benefit preeminently on the obstetrician and the gynæcologist, and also on the whole medical profession, both practising and scientific.

The question of the value of such a diagnostic method needs no elaboration. It is of interest, however, to trace briefly the evolution of the Aschheim-Zondek reaction or test for pregnancy (A.Z.R.).

It was the painstaking and accurate work of Aschheim and Zondek which revealed the functional relation of the anterior lobe of the hypophysis to the female genitalia. By implanting a small piece of the anterior lobe of the pituitary gland in an immature female white mouse, they found in a few days remarkable changes in the ovaries, uterus and vagina.[1] The ovaries were enlarged and contained large ripe follicles and *corpora lutea*, the uterus was of adult size, and the vaginal secretion contained the so-called *"Schollen"* cells—large cornified cells without a nucleus, which we have learned to recognize as being diagnostic of œstrus in the mouse, rat and guinea-pig (see Figure I).[2] [3] [4] In other words, within a few days the genitalia of the mouse assumed all the characters of a mature animal. This was the beginning. Further thorough investigation has enabled Aschheim and Zondek to draw the following conclusions:

1. The hormone of the anterior lobe of the pituitary gland excites the resting ovarian function to activity.

2. The hormone of the anterior lobe of the pituitary gland is the "motor" of sexual function (see Figure II).

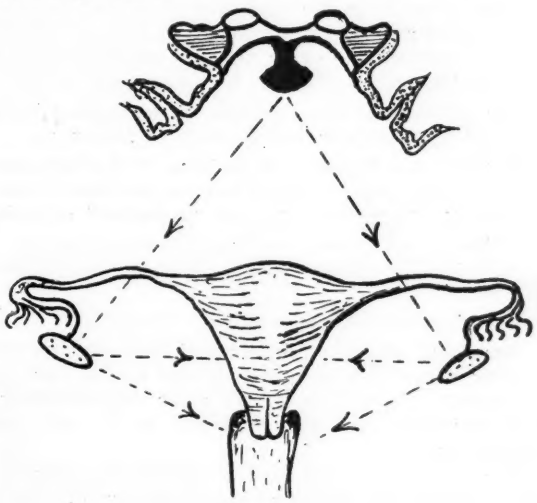

FIGURE II.
Representing the functional relation of the anterior pituitary to the female genitalia. "The anterior pituitary is the motor of sexual function." After Aschheim and Zondek.)

3. In infantile animals it produces ripening of the ova and follicles and liberates thereby the ovarian hormone. It is capable of reviving the ovarian function in old, sexually degenerated animals.

4. The anterior pituitary hormone is the primary (the "motor") and the ovarian the secondary hormone. The ovarian hormone in turn exerts its effect on the uterus and vagina.

In a converse manner it has been shown by Aschner,[5] Biedl,[6] Cushing[7] and others that by removing the pituitary gland in a sexually mature animal we can bring about cessation of the ovarian function.

It is necessary now to consider very briefly the changes in the ovaries as found in the mouse after implantation of a piece of the anterior lobe of a pituitary gland, as these changes form the basis of

[1] This work was carried out under the direction of Geheimrat Professor Dr. Seitz, Universitäts-Frauenklinik, Frankfurt am Main.

our pregnancy reaction or test. They are: (i) large ripe follicles (see Figure III); (ii) blood-filled follicles, which result from bleeding into the distended follicles and will hereafter be called blood points (see Figure IV); (iii) *corpora lutea*—distinct golden yellow points in one or both ovaries (see Figure IV). These three reactions form, then, a test for the anterior pituitary hormone.

The next step: But what connexion has the anterior pituitary hormone with the test for pregnancy? Further investigation resulted in the astounding discovery that during pregnancy enormous quantities of this hormone are excreted in the urine. The presence of the hormone is first detected in the urine about three to five days after the missing of the first period, that is, shortly after embedding of the ovum; the hormone is most concentrated during the earlier months, and finally disappears from the urine about eight days *post partum*. We have therein a definite and reliable test for pregnancy, for it is only after fertilization of the ovum and the establishment of a physiological contact between the ovum and the uterus that this remarkable excretion of the hormone takes place.

The above-mentioned ovarian changes have been grouped by Aschheim and Zondek as follows:

Reaction I.—Ripening of follicles with liberation of œstrin and production of œstrus (detected in the mouse by enlarged uterus and *"Schollen"* cells in vagina).

Reaction II.—Blood points, that is, blood-filled follicles.

Reaction III.—*Corpora lutea.*

Reaction I occurs at times apart from pregnancy; it may occur, for instance, at the menopause, in carcinoma of the cervix and after oophorectomy, and, therefore, is not employed as a test for pregnancy.

The pregnancy reactions are then: Reaction II, blood points, and reaction III, *corpora lutea*. These can be readily recognized by the naked eye (see Figure V).

Technique of the Test.

The technique employed in the Universitäts-Frauenklinik, Frankfurt am Main, is as follows:

The patient is simply requested to send in a bottle containing 100 cubic centimetres of early morning urine. This urine, secreted overnight, contains the hormone in a more concentrated form than that of any other time of the day. Five female white mice from three to four weeks old and weighing from seven to eight grammes are employed for each test. If they weigh less than six grammes, the mice perish rather readily on being injected, and if their weight is above nine grammes, the question of spontaneous formation of *corpora lutea* consequent on maturity naturally complicates the result.

The white mouse as a rule first shows signs of œstrus (that is, maturity) when it is from seven to eight weeks old, by which time it has attained a weight of about fifteen grammes.

Each mouse is given a subcutaneous or intraperitoneal injection of urine and receives in all from 1·2 to 2·4 cubic centimetres over a period of three days. Our practice was to give the mice injections twice daily, giving on the average 0·3 cubic centimetre as a dose. If the animal weighs fully eight grammes, 0·4 cubic centimetre or even 0·5 cubic centimetre can be given.

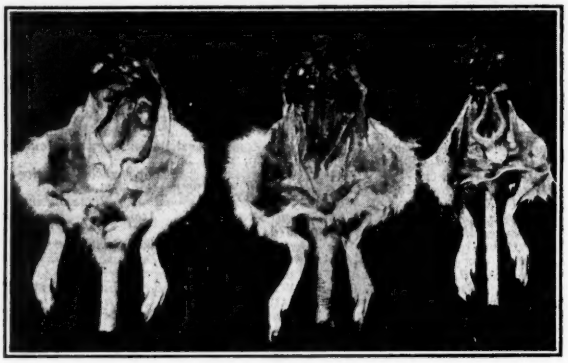

FIGURE V.

A positive result to the pregnancy test (A.Z.R.). In centre there are normal infantile uterus and ovaries. The small thread-like bicornuate uterus can be followed up to the tiny ovary situated immediately below the lower pole of the kidney. On each side of the normal animal is shown a positive Aschheim-Zondek test. The uterus and ovaries considerably enlarged. Blood points and *corpora lutea* are difficult to reproduce in the photograph, but were easily seen in the fresh specimen.

Duration of Reaction and Result.

The animals are killed one hundred hours after the commencement of the test and the ovaries and uterus are then examined. A reaction is considered positive for pregnancy if one single blood point or one single *corpus luteum* is found.

The above description of the technique may appear detailed and the technique perhaps difficult in that apparently extensive laboratory equipment is required. Practically, such is not the case. The requisite equipment, which necessitates no complicated or expensive apparatus, may be obtained at a very small expense. At the research laboratory at the Royal Hospital for Women this test, among other investigations, is being satisfactorily carried out. To quote Aschheim himself: "Immediately one has become acquainted with the method and the laboratory has developed the routine, then everything goes along almost like play."

Practical Results and Statistics.

Aschheim and Zondek,[8] in a statement made over twelve months ago, report having carried out 1,007 tests which, critically surveyed, reveal an error of 1·2%. One of us (K.E.) has performed the test in approximately 3,000 cases during the past three years. During the past twelve months the other of us (B.T.M.) has carried out approximately 600 tests. Our percentage of error has been from 1·5% to 2·0%. The reaction has, moreover, been employed during the past three years in many clinics on the

Continent with an average error of 1·7% in several thousands of cases. More recently in London and Edinburgh and in the United States of America similar satisfactory results have been obtained.

Conclusion.

In the Aschheim-Zondek test we have a method of diagnosing the pregnant state within three to five days after the missing of the first period. By careful confirmation in many clinics in thousands of cases the reliability of the test has been firmly established. As a biological test it must stand preeminent. (The Wassermann test is found to be reliable in from 96% to 97% of cases.) We feel that it is unnecessary to emphasize the practical value of this advance. One has only to be associated with the test in a large obstetrical and gynæcological clinic where it can be readily checked and correlated with the clinical condition, to realize its worth and to be convinced of its value as a sound diagnostic aid.

On the question of the use of the Aschheim-Zondek test in pathological conditions, particularly in hydatid mole, chorion epithelioma and extrauterine gestation, further communications will be made at a later date.

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THE COMPARATIVE PHYSIOLOGY OF ACCOMMODATION: A PROBLEM IN BIOLOGY.

By W. A. OSBORNE, M.B., Ch.B. (Ireland),
Professor of Physiology, University of Melbourne.

IN the accommodation of the eye the end sought after is simple, uncomplicated and purely physical—the formation on the retina of the clearest image possible of some portion of the external world. So many organs have dual functions to perform and so many have psychic accompaniments. Thus muscular contraction in addition to movement produces heat and is serviceable in the circulation of the blood and lymph; the ingestion of food has its social and æsthetic aspect, too often forgotten by dietitians and reformers. Breathing not only aerates the blood, but helps in losing undue heat and carries out the micro-adjustment of the blood reaction. In the eye itself the secretion of tears and the dilatation of the pupil have an emotional association in addition to their separate mechanical performances. But focusing has no auxiliary functions and no psychic complications. The amazing thing is to find throughout the animal kingdom so many diverse ways of achieving the same purpose.

I am obliged to Sir James Barrett for lending me his collection of brochures and reprints dealing with the comparative physiology of accommodation, and I have used the article "*Vergleichende Akkommodationslehre*," by Professor Hess, in the "*Handbuch der Normalen und Pathologischen Physiologie*."

Invertebrates.

In optical apparatus devised by man the invariable method is to vary the distance between receiving surface or point and the lens or lens system. This, the most natural device, is that employed in the invertebrate eyes so far investigated. As is well known, the cephalopods have eyes of remarkable character. As the receptor mosaic is anterior (external) to the nerve layers and blood vessels, vision can be foveal over the whole retinal region. The cephalopod eye is emmetropic or slightly hypermetropic at rest. But by the action of a muscular band anteriorly placed the internal pressure of the "vitreous" can be increased and the lens pushed forward, making the eye myopic to the extent of 12 to 14 diopters. This can be demonstrated by direct stimulation or by treatment with nicotine or muscarin. In the heteropod eye the muscular band is placed posteriorly (internally[1]), but the same mechanism is employed. In the marine worms, *Alcyopida*, a curious method is employed. A small bulb filled with ocular fluid and communicating with the "vitreous" is capable of being squeezed by contractile tissue—fluid is forced into the eyeball and the lens is pushed further away from the retina.

In the nautilus the problem is solved by doing away with accommodation altogether, the eye here being a pinhole camera with no lens. Though the definition may be good, the illumination must be poor.

Fish.

In fish the plan is adhered to of altering the distances between lens and retina. A remarkable muscle, the campanula, pulls the lens towards the retina in active accommodation; in rest, therefore, the eye is focused for near vision and accommodates by this muscle for distant objects. That curious teleostean, the *Periophthalmus* or periscope fish, which must accommodate in air and not in water, uses a reverse process, that is, by muscular contraction the lens is pulled forward and so active focusing takes place for near objects.

Amphibia.

In amphibia the eye at rest focuses distant objects, but by the contraction of a muscle or two muscles stretching from the posterior surface of the iris to the anterior lens the latter can be drawn forward to allow near objects to have their images on the retina. The movement of the lens is not what a physicist would desire and the details vary somewhat. Thus in Urodela the lens is drawn forwards and upwards.

[1] From the standpoint of the body as a whole, not of the eyeball.

Reptiles and Birds.

In reptiles and birds we have for the first time in the evolutionary scale the abandonment of the device of altering the distance between lens and retina, which so commends itself to the physicist, and the adoption of a new principle unknown in optical instruments invented by man, namely, accommodating by altering the shape of the lens. Like our own eye, the bird's and lizard's is, at rest, focused for distant objects. To accommodate for near objects the muscular ring at the root of the iris squeezes the lens and makes it more convex, particularly on the anterior aspect. By this device a wide range of accommodation can be made available. Perhaps the bird's eye has the best mechanism of any in the animal kingdom, except for the unfortunate vertebrate heritage of having the nerve layers and blood vessels between lens and receptors. The range of accommodation of the cormorant has been found to be 40 to 50 diopters, or three times that of man. If only the specifications of the cuttlefish eye had been begged, borrowed or stolen, what a superb optical instrument the bird's eye could be!

Mammal.

In the mammal we have the form familiar as our own. The lens at rest is kept stretched; when the ciliary muscle contracts, the lens is freed from tension and by elasticity bulges and so accommodation for near objects is effected. This is surely an inferior method to that found in birds and lizards. The human lens may be said to age from the date of birth and the faulty mechanism becomes sadly apparent in middle life, when we play the trombone with a book, to use Wendell Holmes's metaphor.

The varying devices employed and the varying success achieved present a strange biological problem. Were we presented with the facts without any bias in favour of natural selection or special creation, we should with difficulty avoid the idea that a designing intelligence had been at work, some might say several intelligences working in ignorance of each other, others might suggest an intelligence that experimented and used freely methods of trial and error.

Anyhow, the facts form a strange commentary on Sir James Jeans's belief that the Architect of the Universe is a higher mathematician!

Reports of Cases.

A CASE OF AGRANULOCYTIC ANGINA.

By MAISIE H. ASHER, M.A., M.B., Ch.M.,
Bexley, New South Wales.

I saw Miss X., aged forty-four, at her home on April 20, 1931. She said that she had had a swelling of the neck and a sore throat about fourteen days previously and she had felt very ill. A few days after the onset she thought an abscess broke in her throat, for she spat out much pus. She then noticed that she was having difficulty in voiding urine; she also thought she had piles. About the same time a painful red patch appeared around the umbilicus. She did not stay in bed, but persisted in carrying out her home duties. Three days prior to her sending for me she had a shivering attack. She had had rheumatoid arthritis while in her teens; she was undergoing treatment by an orthopædist for the deformities resulting from that affection.

On examination her temperature was 40·2° C. (104·5° F.), her pulse rate 120 and her respiratory rate 20. There was a painful inflamed area about 7·5 centimetres (three inches) in diameter around the umbilicus. There was marked inflammation of the vulva and perianal region; on the latter region there were several papular spots which later became necrosed. The throat condition had practically cleared. Nothing abnormal was found in the respiratory and circulatory systems. There was complete retention of urine; a catheter specimen showed only a trace of albumin.

That night the temperature rose to 41·1° C. (106° F.) and from then on varied between 39·4° and 40·9° C. (103° and 105·8° F.); the respirations increased to 44. The patient complained only of retention and lassitude. Attempts at blood culture yielded no organisms and the media remained sterile on successive days.

On April 23 Dr. Holmes à Court saw the patient in consultation with me and he diagnosed the condition as that of agranulocytic angina.

The diagnosis was confirmed by a blood count, which was as follows: Red cells, 3,900,000 (these were normal in appearance); leucocytes, 232 per cubic millimetre. The examination of a blood film revealed only five small lymphocytes. The patient died on April 25.

Reviews.

A DIETICIAN DISCUSSES DIET.

DIETICIANS have already proved their value in relation to hospital administration and medical treatment. In America their work has tended to be elevated to a separate profession. The disadvantages of approaching this aspect of therapy without medical knowledge are illustrated in "Dietetics and Nutrition," by Maude A. Perry, B.S., formerly Director of Dietetics at the Michael Reese Hospital, Chicago.[1]

The first portion of the book deals with normal diet and nutrition. This subject is approached rather as a part of chemistry than of physiology, and is in certain respects inadequate. Furthermore, exception can be taken to many statements. For example, milk, although a most valuable foodstuff, has not the exceptional virtues attributed to it by the author. She states: "About one-third of the caloric need of school children should be furnished by milk" (page 117). This fallacy is not infrequently the cause of nutritional disorders in early childhood. It is also advised that no meat or fish be added to the diet until after the third year of age. Diet in disease is dealt with in the last half of this work. In this the dietary tables given are of practical value and might well have been extended to include detailed recipes. The theoretical consideration of disease processes and their relation to diet is not always so satisfactory. On page 144 it is stated: "It is apparent that urinalysis must be our guide in the dietetic treatment of diabetes." Blood sugar estimation is not mentioned. In discussing nephritis no distinction is made between the varieties of this kidney disorder. It is remarked: "Careful dieting will relieve most cases of chronic nephritis and will cure many cases of acute nephritis" (page 162). A greater knowledge of medicine would prevent inaccuracies of this kind.

In her preface the author says: "It is my aim to present scientific and technical material in plain and simple language to meet the needs of schools, training schools for nurses, graduate nurses, physicians, mothers, and all others interested in personal and public health problems." This commendable desire to be at once popular and scientific cannot be said to have succeeded.

[1] "Dietetics and Nutrition," by Maude A. Perry, B.S.; 1930. St. Louis: The C. V. Mosby Company; Melbourne: W. Ramsay. Demy 8vo., pp. 332. Price: $2.50 net.

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THE ANÆSTHETIST'S FEE.

WHEN a surgeon advises a patient that an operation is a necessary part of treatment, the patient as a rule leaves all the arrangements in the hands of the surgeon. The surgeon secures the services of an anæsthetist. The latter may or may not be the patient's regular medical attendant. Many surgeons are in the habit of working with one anæsthetist, probably because they have learned to have confidence in his judgement. In these circumstances the patient may not know the anæsthetist even by repute and may see him for the first time when the preliminary examination of the patient's heart, lungs and so forth is made. This examination may have to be made, especially when operation is undertaken as an urgent measure, when the patient is actually on the operating table and the preparations for operation are in progress. In any case the fact that the patient allows himself to be anæsthetized must be taken as his acquiescence in the arrangements made by the surgeon. If the patient is a minor, acquiescence on the part of parent or guardian may be taken for granted if the parent or guardian knows that an operation is to take place and has agreed to its performance.

Some little time ago the question of the responsibility of the surgeon for the payment of the anæsthetist's fee was raised in Victoria. Legal advice was taken on the matter by the Council of the Victorian Branch of the British Medical Association, and the matter was also referred to the Association's solicitors in England. The recent experience of a practitioner in another State has directed attention again to the question. An anæsthetist was asked by a surgeon to give anæsthetics on three occasions to three children of a family. Two of the operations were undertaken for serious conditions and the children were very ill. When the father received his account he refused to pay and told the anæsthetist that he knew nothing of him in the matter. The anæsthetist was told by his solicitor that he had little chance of recovering the amount owed, and rather than embark on expensive litigation, the anæsthetist let the matter drop.

When the Victorian case was referred to the legal advisers of the Branch, they stated that two views were open as to the legal position:

1. The surgeon may be taken to have been engaged by the patient to perform the operation and to have received authority to engage an anæsthetist on the patient's behalf, or

2. The surgeon may be taken to have contracted with the patient to perform the operation and to provide at his own expense all necessary services connected with the operation.

They thought that the first of these alternatives set out the true legal position and advised as follows:

1. The surgeon having engaged the anæsthetist, as agent for the patient, is not personally liable to the anæsthetist for his fee.

2. The anæsthetist may sue the patient and as a matter of law may look to the patient for his fee, and has no legal claim against the surgeon.

3. The anæsthetist's fee is payable by the patient any time after the operation, when demanded.

They then went on to state:

It is arguable that the surgeon should be taken to be authorized by the patient not only to engage the anæsthetist, but also to pay him on the patient's behalf. If the surgeon's authority went so far as this, he would be under no obligation to pay the anæsthetist, but if he did so, could recover from the patient the amount he paid, not as fees for "medical services," but as money paid on behalf of the patient. We are of opinion, however, that unless the surgeon has been specially requested by the patient to pay the anæsthetist, the authority is only to engage the anæsthetist and not to pay him.

We understand that it is a frequent and approved practice for the surgeon to pay the anæsthetist and to add to his account against the patient the amount so paid. Though there is no legal objection to this course being followed, it does not in our opinion alter the position. The surgeon, in our opinion, could not sue the patient for the anæsthetist's fee even if he had himself paid it. If he charges the anæsthetist's fee in his own account, he must be taken to be doing so merely as agent for the anæsthetist, and if he pays the fee out of his own pocket, he does so at his own risk without acquiring any right to recover from the patient the amount so paid.

The legal advisers of the Association in England agreed that no action would be maintainable against the surgeon by the anæsthetist. They could not altogether agree that if the surgeon paid the anæsthetist, he did so at his own risk without acquiring any right to recover from the patient the amount so paid. They stated:

It is settled law that the agent has a right to look to the principal to reimburse him in respect to all expenses incurred in the reasonable performance of the agency, and we do not think that a surgeon would require special authority from the patient to pay the anæsthetist in order to enable him to recover his fee as a disbursement made on behalf of the patient.

Later on in their communication they stated:

Despite what we have said as to our view of the surgeon's right to recover against the patient if he has made such a disbursement, we do not think he is necessarily made liable thereby to the anæsthetist, or that his right to make such a payment and to recover it from the patient makes him legally liable therefor.

From a consideration of these legal opinions it is clear that in the recent case previously mentioned the anæsthetist would probably have recovered his fee had he taken the case to court. This case, however, is not our immediate concern; it is mentioned for the purpose of warning others. We must deal rather with general principles. The following conclusions may therefore be stated. In the first place the surgeon is not responsible for the anæsthetist's fee; he acts merely as agent for the patient in engaging the anæsthetist. Secondly, by submitting to anæsthesia the patient accepts the services of the anæsthetist and ratifies what the surgeon has done as his agent. Were it not so, the anæsthetist would, of course, be guilty of an assault. If the patient were unconscious and the condition from which he was suffering demanded urgent treatment, the surgeon would be the agent of necessity of the patient; as such he would have authority to engage an anæsthetist and in these circumstances there would be no question of assault. Lastly, the anæsthetist should look to the patient for his fee. Anæsthetists would therefore be well advised to look upon the giving of an anæsthetic in the same way as they regard any other attendance on patients in their own private practices.

Current Comment.

ALLERGY.

IN the United States of America, where specialism seems to be carried almost to an extreme, there are medical practitioners who dub themselves "allergists." If these "allergists" believe only half of what is written about allergy, they might do the work of general practitioners and still confine their activities to their specialty; for there are few manifestations of human illness that, at some time or other, have not been set down as allergic phenomena. Allergy occupies quite a prominent position among the medical fashions of today; it is of very great importance, and much nonsense has been written about it. Occasionally, however, valuable work on the subject is produced. The investigations of G. H. Oriel are important; they bid fair to result in the acquisition of knowledge that should be of great assistance to students of allergy and to medical practitioners engaged in the treatment of allergic disorders. Reference was made in these pages to his work on asthma at Guy's Hospital in March, 1930, and again in April, 1931. Oriel has made a further contribution in a paper that he read recently before the Section of Dermatology of the Royal Society of Medicine.[1] In introducing his subject he remarks that if the blood serum of a person who is sensitized to eggs, is injected intradermally into a normal person, and the injection is followed twenty-four hours later by the administration of egg by the mouth, a wheal appears at the site of injection in a certain proportion of cases. This proves that the antigen circulates in the blood. What, then, is the path by which the antigen is eliminated? It may be destroyed by ferments, or it may be excreted in the urine or fæces. Oriel, as previously reported in the work from Guy's Hospital Asthma Clinic, has succeeded in isolating from the urine of persons suffering from allergic disorders, a substance that he regards as the antigen. Its chemical nature has not been fully determined; it bears some resemblances to the proteoses. An intradermal injection of an exceedingly minute quantity of the substance into a sensitive person causes the appearance of a wheal and an erythematous areola; no reaction occurs in the skin of a non-sensitive person. The isolated uterus of an actively sensitized guinea-pig contracts sharply when the substance is applied to it; but the sub-

[1] *Proceedings of the Royal Society of Medicine*, July 1931.

stance has no effect on the uterus of an animal that has not been sensitized. A guinea-pig was passively sensitized by injection of the blood serum of the person from whose urine the antigen had been extracted. This animal's uterus contracted when the substance was applied to it; but the uterus of an animal that had been sensitized by the injection of another serum did not contract.

Oriel goes on to state that eczema may be due to some antigen from within the body; but it does not necessarily follow that the antigen comes from the alimentary tract. It is possible that a suitable antigen may be produced sometimes by the action of bacteria upon the tissues. He remarks that probably every true antigen contains a protein molecule. It has been shown that, if an iodine atom is combined in a protein molecule, the resulting substance is entirely different antigenetically to either the protein or the iodine; probably the sensitization of some persons to iodine may be accounted for by the combination of iodine with body tissues, which then act as a foreign protein. He quotes the case of a patient who was sensitive to aspirin and from whose urine a proteose-like substance was extracted. This patient did not react to the intradermal injection of a quantity of the substance unless he was actually taking aspirin. The suggestion is that the action of the aspirin on the tissues resulted in the formation of a suitable antigen. Oriel further suggests that bacterial activity may cause the production of antigen in a similar manner; the removal of septic foci results in relief of the allergic disorder.

Oriel showed a patient who, eighteen months previously, had suffered from almost continuous asthma and whose skin surface had been almost completely covered with eczema. He had been treated by means of weekly injections of the proteose-like substance obtained from his urine. The condition of his skin had improved in a remarkable manner, and he had been free of asthma for a period of twelve months. Oriel suggests that the specificity of the proteose-like substance in this case receives further confirmation in that, during the early part of treatment, the patient suffered a pronounced exacerbation of both his asthma and his eczema.

In the discussion that followed, it was pointed out that the administration of the proteose-like substance had resulted in a cure in some cases in which other methods of attempted desensitization had failed. It was stressed that exceedingly minute doses of the substance had to be employed; obviously the reactions were not due merely to the protein contained in it. If the theory is correct that antigen may be produced by bacterial or chemical action on the tissues, an explanation will be provided for many cases of asthma, eczema *et cetera*, that hitherto have baffled the research worker and the clinician. Every medical practitioner who has to treat persons suffering from allergic disorders, knows how difficult it sometimes is to discover a sensitizing agent.

The urinary extract discovered by Oriel (if it is indeed a specific antigen) might be of inestimable value in treatment. In many respects it is analogous to an autogenous vaccine; perhaps it will come to occupy an equally important place among the materials available for therapeutic purposes.

HYPERVITAMINOSIS.

THESE are the days of catch phrases, of wild enthusiasm for matters of passing moment, and of fashions which are done to death. The general public is taught that vitamins are essential to growth and health; foods and medicines are advertised to the public on account of their vitamin content; and the fact that an excess of vitamin may be harmful is seldom, if ever, mentioned. The public cannot be blamed if it becomes over enthusiastic; the public should, of course, be guided in these matters by the medical profession, and it is therefore essential that medical practitioners should realize to the full all the possibilities that may result from the administration of vitamins. It is with this object that attention is drawn to a recent report by Lewis Thatcher.[1]

Thatcher's patient was a boy, aged eighteen months, who was admitted to hospital with a history of general weakness, anorexia and refusal to take solid food. Difficulty in regard to feeding had been experienced from birth; the child was weaned at five months, but he failed to gain in weight and digestive disturbance was persistent. Five months before admission to hospital he had an attack of diarrhœa and was given irradiated ergosterol; this was continued till the time of admission. Some urinary symptoms were manifest and a diagnosis of pyelonephritis was made. The child became steadily worse and died twelve days after admission. At *post mortem* examination both kidneys were found to be enlarged and firm and of a pale yellowish colour. Deposits of calcium were visible to the unaided eye as tiny, greyish, gritty particles in the medulla. On microscopical examination deposits of calcium were found throughout the medulla. No calcium deposits were found apart from those in the kidney. Thatcher points out that the changes closely resembled those described in experimental hypervitaminosis *D*. The fact that the deposits were limited to the kidneys and that the spleen was not involved suggests that the condition was relatively mild. It is important to note that no sign of present or past rickets was noted and that the dose of irradiated ergosterol received by the child for five months was four teaspoonfuls a day, "equal to about twice the recommended curative dose." Thatcher concludes that the possibility of idiosyncrasy constitutes a real danger. He adds that the symptoms of intolerance are well defined and that non-rhachitic are more susceptible than rhachitic babies.

[1] *Edinburgh Medical Journal*, April, 1931.

Abstracts from Current Medical Literature.

DERMATOLOGY.

Hypersensitivity to Trichophytin.

I. ROSEN, S. M. PECK AND N. SOBEL (*Archives of Dermatology and Syphilology*, June, 1931) have conducted a series of experiments on 102 casual skin patients for the purpose of testing the allergic properties of the skin to trichophytin. Twelve of the patients gave strongly positive reactions, twenty-three gave positive reactions, thirty-two gave weak positive reactions, eight gave reactions which were doubtful, and in twenty-seven instances no reaction was obtained. The number of positive reactions increased rapidly after the twenty-first year of age. The feet of ninety-seven patients were examined clinically. Twenty-five gave no evidence of fungus infection. Fourteen presented a typical picture of interdigital mycosis and fifty-eight manifested some scaling and maceration between the toes. In forty-eight cases microscopical examinations for fungi were carried out; in only nine could the fungus be demonstrated. Eight of the nine patients gave a positive reaction to the trichophytin test. Three methods were used: the intradermal, the von Pirquet method and the patch test. The intradermal method was found to be the most reliable. Zürich trichophytin was used. In some cases trichophytin Hoechst was used for purposes of comparison; this caused a far stronger reaction.

Tolerance for Dextrose in Acne Vulgaris.

S. S. GREENBAUM (*Archives of Dermatology and Syphilology*, June, 1931), by a series of experiments in cases of *acne vulgaris*, tries to throw light on the pathogenesis of this condition by means of tests of tolerance for dextrose and to determine whether a concealed intolerance may not explain why pustulation is so common in this disease. Sugar metabolism in *acne vulgaris* has been studied by numerous authors from the quantitative viewpoint, but not from that of tolerance. The method followed by the author was to give each patient 1·8 grammes of dextrose per kilogram of body weight, dissolved in 2·5 cubic centimetres of water. The solution was given on an empty stomach and samples of blood were withdrawn at once, one half, one, one and a half and two hours after the subject received the dextrose. The result was considered abnormal if the sugar level rose over 180 milligrammes *per centum* or was not normal at the end of two hours. The author concludes firstly that if intolerance for dextrose is present in acne, it is not present in all types, or even in all pustular types; and secondly, that if there is any connexion between intake of sugar and pustular acne or if intolerance for sugar is part of an endocrine imbalance generally believed to be present in acne, this test does not appear to be of assistance in protecting it. However, the explanation of the clinical phenomena may lie in the endogenous periodicity of the blood sugar content as recently emphasized by Mollerström.

The Senear-Usher Syndrome.

R. L. GILMAN (*Archives of Dermatology and Syphilology*, July, 1931) describes a case combining the features of *lupus erythematosus* and pemphigus. A discussion is also given of other cases which have been reported and which correspond to those submitted by the authors in 1926. It is held that these cases represent a toxic dermatosis midway between *lupus erythematosus disseminatus* and pemphigus, occurring chiefly in middle-aged persons and running a comparatively benign course. The author's patient was a dark-skinned woman, aged forty-nine years. The eruption started eighteen months before the author saw her, as a papule on the nose, and it afterwards involved both cheeks and the bridge of the nose, producing the "butterfly" appearance typical of *lupus erythematosus*. Later brillæ appeared on the breast and back, which became crusted and keratotic. The scalp became involved similarly to the face, with loss of hair.

Heterothallism Among the Dermatophytes.

D. SPRING (*Archives of Dermatology and Syphilology*, July, 1931) states that the occurrence of heterothallism in the pathogenic fungi of man and animals is worthy of investigation, both morphologically and physiologically, for, if established, it would have important pathogenic significance. The author carried out a series of experiments in three of the commoner species. Heterothallism is defined as that property of certain fungi whereby two different cells or hyphæ, although identical morphologically, possess such different sexual properties that, on uniting, they can produce a new form. It is claimed that monospore technique with these fungus cells is not difficult. In the three strains of two species tested, *Trichophyton interdigitale* and *Trichophyton purpureum*, heterothallism cannot be distinguished with finality. There were differences in the surface configuration of one strain of *Trichophyton interdigitale* and in the pleomorphism as well as in the surface of a second strain. However, in the presence of pleomorphism a significance in the direction of heterothallism cannot be assigned to these phenomena unless it is first demonstrated that pleomorphism itself can be a heterothallic expression. Incidentally it was found that the same kind of a colony developed from such highly specialized structures as fuseaux as developed from less specialized ones as aleuries. With the human dermatophytes the author had the same experience as other workers in single cell technique: approximately 50% of aleuries and fuseaux failed to develop to maturity.

Amœbiasis Cutis.

M. F. ENGMAN AND H. E. MELENEY (*Archives of Dermatology and Syphilology*, July, 1931) report two cases of ulceration of the skin caused by the *Endamœba histolytica*. This condition in both instances followed operation and was caused by amœbic infection of the skin from a deep-seated sore. In the first case the condition followed an operation for resection of a portion of the colon involved in an amœbic ulceration. In the second case it followed drainage of an amœbic abscess of the liver. In the first case typical *Endamœba histolytica* was found in smears and sections from a biopsy specimen of an ulcer of the skin. The resected colon was affected by an old ulcerative process typical of amœbiasis, but characteristic amœbæ were not demonstrated in sections of the latter. In the second case typical *Endamœba histolytica* was found in sections from a biopsy specimen of an ulcer of the skin and in autopsy sections from the floor of the ulcer, from the subcutaneous fat, from muscle tissue of the abdominal wall, from the abscess of the liver and from small ulcers in the colon. The authors suggest that cases similar to those described by them should be studied by the most approved protozoological methods.

UROLOGY.

Urinary Retention.

F. LEGEN AND DOSSOL (*La Presse Médicale*, January 21, 1931) discusses the cause, urethroscopic findings and the mechanics of urinary retention due to interference at the vesical outlet (*dysectasie du col*). Pointing out that in hypertrophy and cancer of the prostate the size of the gland bears no relation to the severity of the symptoms, the authors state that retention is more commonly due to rigidity of the vesical neck than to tortuosity of or organic obstruction to the posterior part of the urethra. Thus they explain retentions due to prostatitis *et cetera* rather than on the grounds of occlusion due to œdema or infiltration. Such cases may be treated by ablation of the vesical neck, and pathologically a variety of lesions are found, all calculated to interfere with the mobility of the proximal part of the urethra. Detailed urethroscopic findings are given, the essential abnormalities being failure of the separation of the lateral walls and immobility of the urethral crest during the act of micturition. These features may be separate or combined. Mechanically the difficulty is either structural rigidity of the bladder neck or interference with the dynamics of the sphincter. However minute, anatomic lesions are liable to decrease elasticity. In purely nervous lesions the fault

lies in reflex sphincter inhibition, the bladder being unaffected as the continued desire for micturition shows. It is unlikely that the trigonal muscle is at fault, as it is more often seen hypertrophied than atrophied in these circumstances. Spasm of the sphincter is excluded by the facility with which sounds are passed, and hypertonicity is stated to be the basic affection. This would be transitory were it not superadded to inflammation leading to disturbance of anatomical relations. Surgical ablation of the neck is advocated as the most successful treatment.

Renal Tuberculosis.

IN a study of ninety-five cases of renal tuberculosis, R. Gutiérrez (*Journal d'Urologie*, February, 1931) presents several tables for the study of this condition. The average age of his patients was thirty years, the youngest being eleven and the oldest sixty years. In diagnosis he stresses the necessity for demonstrating decreased renal function on the affected side as an indication of an anatomico-pathological lesion. He is a thorough believer in confirming his findings by pyelo-ureterograms in all cases. Intravenous pyelography is used only when the instrumental method fails. The relative frequency of symptoms is shown in a table indicating the percentage of cases in which each symptom occurs. In treatment the author strongly advocates nephro-ureterectomy whenever the ureter is involved. He advises division and ligature of the ureter above the bladder through a lumbo-inguinal incision under regional anæsthesia. This is immediately followed by nephrectomy under general or paravertebral anæsthesia. He also emphasizes the progressive nature of the disease and illustrates his remarks by pyelograms of one of his cases. He points out that in early cases simple nephrectomy practically always leads to cure. When the ureter and bladder become involved, more severe operations and more prolonged after-treatment are required.

Pyometra in a Male Pseudo-Hermaphrodite.

R. P. MIDDLETON (*New England Journal of Medicine*, April 30, 1931) claims the first recorded case of pyometra in a male pseudo-hermaphrodite. His patient was a student, aged nineteen years. At birth he had undescended testes and perineal hypospadias. There was a history of urinary infection thirteen years earlier, and two operations for the cure of hypospadias had been partially successful. One year before coming under observation he developed "cystitis" following influenza, and had chronic pyuria since. There had never been any doubt of his masculinity, and secondary male characteristics were well developed. The scrotum, however, was empty and there was a furrow in the site of the median *raphé*, but no vagina. Two operations for repair of fistulæ failed in spite of perineal deviation of urine, and pyuria became very pronounced. Rectal examination then revealed a large mass high up between bladder and sacrum, which was thought to be a malignant undescended testis. No secondary growths were found, and laparotomy was performed. At operation a uterus was found distended with pus. There were no round ligaments, but the broad ligament was represented by a peritoneal fold inclosing a fibrous cord which entered the uterus low in the pelvis. The pseudo broad ligament had a peritoneal attachment to the lateral pelvic wall which enclosed the testis (one being removed for proof of sex) and the fibrous cord represented the *vas deferens*. The uterus was drained *per urethram* by a separate catheter and was irrigated until moderately clean. Transabdominal extirpation was then carried out.

Vesical Tuberculosis.

L. R. KAUPMAN (*Urologic and Cutaneous Review*, May, 1931) advocates more frequent use of the cystoscope in vesical tuberculosis, believing the findings by this method of examination to be most reliable. In diagnosis of doubtful cases he recommends progressive charting of lesions, such as is practised in vesical tumour. Most of his cystoscopic work is carried out at the bedside under local anæsthesia with a 5% solution of "Novocain," which is used to distend the bladder. By this means the patient comes to regard cystoscopy as routine treatment and his fears of a surgical procedure are allayed. Whenever it is possible, the diagnosis is confirmed by the demonstration of the tubercle bacillus, by pyelography and by renal function tests. In treating patients whose condition is refractory after nephrectomy, he has had more success with Rovsing's carbolic acid method than with any other. Electrodesiccation is used for persistent erythematous or hyperplastic ulcers which are strictly localized. A few female patients with no bladder lesion and no demonstrable tubercle bacilli in the urine have been cured of frequency by dilatation of the urethra and instillation of colloidal silver. In men, non-specific adnexal infections may account for persistence of frequency of micturition and scalding. Occasionally, more often among women, the author reluctantly finds it necessary to attribute the persistence of symptoms after nephrectomy to a neurosis. For this condition he has no advice except to abstain from futile treatment.

Carcinoma of the Penis.

FIFTY personal cases of penile carcinoma are reviewed by F. H. Colby and G. G. Smith (*Journal of Urology*, May, 1931). All were epidermoid carcinomata and they are arbitrarily divided by histological methods into high and low grades of malignancy. Nearly half the patients had suffered from phimosis and none had been circumcised in infancy or childhood. The post-operative survival rate is considerably higher amongst those with carcinoma of low histological malignancy and in these cases the average duration of symptoms was only eight months as opposed to fourteen months for those of high grade malignancy. The authors recommend that groin dissection be carried out in every case, except when the disease is of short duration; in these circumstances conservative surgery is permissible.

Congenital Syphilis of the Bladder.

B. VALVERDE (*Journal d'Urologie*, May, 1931) reports the discovery of four cases of late hereditary syphilis of the bladder in the course of routine cystoscopy in chronic gonorrhœal posterior urethritis. In all his cases the Wassermann reaction gave no result and the personal history did not suggest previous infection. All the lesions responded rapidly to treatment with antisyphilitic remedies. The author believes cystoscopy is of the greatest importance, not only in diagnosis, but also from a prophylactic point of view. Only by this means can very grave complications be averted. The lesions were all ulcerative, and this is regarded as typical of the epithelial manifestations of late hereditary syphilis. The author also pleads for routine cystoscopy in urological clinics on the ground that unexpected findings are often of great value to the health of the patient and of great scientific interest.

Ureteral Polypi.

Two cases of bilateral ureteral polypi are recorded by E. Chauvain and M. Romien (*Urologic and Cutaneous Review*, July, 1931). Biopsy was performed on one side in the second case on account of the unusual appearance of the tumour. Microscopically it showed all the characteristics of a true adenoma in process of cystic degeneration. It consisted of branching tubes lined with columnar epithelium, some of the cells of which appeared to have undergone mucinoid changes and resembled Lieberkühn's glands. The authors regard the origin of this tumour as a true ureteric gland, basing their contention on a study of comparative histology, as such ureteric glands have been found in the horse. Consensus of opinion at the present time favours total nephro-ureterectomy for such tumours, but this treatment is excluded when the condition is bilateral. The authors advise cystoscopic diathermy, radical measures only being resorted to if recurrence takes place and the surgeon's hand is forced by hæmorrhage or pain. Uretero-pyelography is then practised to demonstrate the actual condition in the pelvis and ureter. A low ureterectomy with uretero-cystoneostomy or total ureterectomy and nephrostomy may be required, but are not to be expected to confer any lasting benefit.

Special Articles on Aids to Diagnosis.

(Contributed by Request.)

II.

THE INTERPRETATION AND CLINICAL SIGNIFICANCE OF BLOOD SUGAR ESTIMATIONS.

THE interpretation of blood sugar curves and their clinical significance must be undertaken with care, otherwise erroneous conclusions may be reached. A laboratory report must always be interpreted with due regard for clinical findings.

Single Blood Sugar Estimations.

Usually when a blood sugar estimation is required, sugar has been found in the urine at some period in the twenty-four hours, and it depends greatly upon the type of case whether a single blood sugar estimation will give definite information or not. In interpreting the results of a single blood sugar estimation the time at which the blood was taken and the time of the last meal must be taken into consideration. Another factor is the height of the renal threshold. An individual may have a raised blood sugar content and yet not pass sugar in the urine. This occurs in some cases of diabetes and in arteriosclerosis with glycosuria due to sclerosis of the vessels of the pancreas, and is caused by a raised renal threshold for sugar. Conversely, a patient may pass sugar in the urine with a normal blood sugar content. This condition of lowered renal threshold is common and may occur at any age; it may be congenital or acquired. It not infrequently happens that patients with diabetes also show a lowered threshold to glucose. According to various authorities 20% to 45% of pregnant women manifest a lowered threshold to glucose in the latter months of pregnancy. The threshold is altered by anæsthetics and by coal tar antipyretics given over long intervals. The normal threshold for glucose has been shown to be between 160 and 180 milligrammes per hundred cubic centimetres of blood. The exact determination of the threshold is difficult.

Diabetes.

In severe cases of diabetes with the clinical picture well developed, a single blood sugar estimation made while the patient is fasting will frequently give all the information required and clinch the diagnosis. During treatment single blood sugar estimations made while the patient is fasting or at a known period after a meal are of the greatest value. Only very occasionally is a glucose tolerance test necessary in these cases, and the advisability of giving fifty grammes of glucose to a patient with a high blood sugar content while fasting is questionable. During treatment, and when the blood sugar content during fasting has returned to normal, the test is unnecessary and is very apt to upset any tolerance for carbohydrate which has been acquired. One case is quoted by Joslin in which the tolerance for glucose was diminished for four months after a glucose tolerance test carried out during treatment.

In mild cases of diabetes, when the blood sugar content during fasting is normal, a glucose tolerance test is often necessary for diagnosis.

Glycosuria in Pregnancy.

In regard to glycosuria in pregnancy, if an estimation of the blood sugar during fasting gives a result definitely above normal, diabetes can be diagnosed, but if the figure is normal or below normal, a glucose tolerance test should be made.

Endocrine Disturbances.

Thyreoid Gland.—In hyperthyreoidism glycosuria may occur, but unless there is a coexisting diabetic condition the blood sugar content during fasting is normal and its estimation gives little information. In hypothyreoid states the blood sugar during fasting may be lower than normal.

Pituitary Gland.—The glycosuria consequent upon hyperactivity of the pituitary gland may be of any grade and varies with the activity of the gland. A single blood sugar estimation will be of help only in the more severe cases. In hypopituitarism carbohydrate tolerance may be increased.

Suprarenal Glands.—Adrenalin acts by causing the liver to break down more glycogen than normal, thereby causing hyperglycæmia and glycosuria. Some types of nervous glycosuria are due to stimulation by the adrenals and are transitory.

Obesity.

When information is required as to the carbohydrate metabolism in obesity unrelated to endocrine conditions, a determination of the blood sugar content during fasting is of little value as it is usually normal. Joslin's observation that diabetes is largely the penalty of obesity should be borne in mind and even when the patient does not show any glycosuria during the routine examination, a glucose tolerance test may reveal some defect.

Renal Glycosuria.

Little information is gained by a single blood sugar estimation in renal glycosuria and a definite diagnosis is almost impossible without a glucose tolerance test.

The Interpretation and Clinical Significance of the Glucose Tolerance Test.

The usual method of procedure for the carrying out of the glucose tolerance test is as follows. The blood sugar is estimated with the patient fasting and a specimen of urine is obtained. Fifty grammes of glucose are then given by mouth and the blood sugar is estimated at half-hourly intervals for two hours. Specimens of urine are collected at the end of one and two hours.

Capillary blood obtained by pricking the finger is usually used for the estimations. As far as possible all disturbing factors should be eliminated during the test. The patient should be kept at rest and smoking prohibited.

In normal people the blood sugar content during fasting lies between 0·08% and 0·12%. The upper limit after 50 grammes of glucose in young adults is 0·18% and the return to the fasting level should be complete at the end of two hours.

Certain changes take place in the sugar tolerance in old age, when a higher rise and a slower fall are common. If nausea follows the drinking of the glucose, the usual rise in the blood sugar concentration at the end of the first half hour may be absent, and if it occurs during the test, there is often a drop in the blood sugar value. The drops are sometimes seen without any definite cause. Hale-White and Payne have shown that five main types of curve are obtained after 50 grammes of glucose in glycosuria: (i) Normal curve throughout; (ii) normal blood sugar during fasting, normal peak, slow return; (iii) normal blood sugar during fasting, high peak, normal return; (iv) normal blood sugar during fasting, high peak, slow return; (v) abnormal throughout, high blood sugar during fasting, high peak, slow return.

In no case should the interpretation of any result be undertaken without due regard for the clinical symptoms present.

The various conditions in which these types of curves occur will now be discussed.

Diabetes and So-called Alimentary Glycosuria.

Patients with moderately severe *diabetes mellitus* give a curve corresponding to type (v), with sugar and acetone in the urine while the test is being made. Although the blood sugar level during fasting is usually above normal, it is not always above the renal threshold and sugar will not be detected in the urine passed during fasting. If sugar is present, the blood sugar during fasting should be estimated before the glucose is given, and if the concentration is above 0·2%, the test is unnecessary, especially if acetonuria is also present. A curve of type (v) is supposed to be diagnostic of *diabetes mellitus*.

Glycosuria of persons giving curves of type (iv) with sugar, but no acetone, in the urine while the test is being

made, is by some authorities believed to be hepatic in origin and not due to a milder form of true diabetes. There is little doubt, however, that, unless treated as diabetics, many of these patients develop symptoms indistinguishable from those in true *diabetes mellitus*. Curves of this type with glycosuria and acetonuria are diabetic for all intents and purposes.

Curves of type (iii) occasionally seen in suspected cases of diabetes are due to defective liver storage and by some authorities are regarded as indicating the first stage of *diabetes mellitus*. Others regard this type as being of little or no importance. The curve is seen in definite liver disease, such as cirrhosis and poisoning by certain drugs, when its clinical significance is clear and its cause obvious. By some authorities it is referred to as the lag and church-steeple type of curve. Acetonuria is seldom, if ever, present while the test is being made. When this result is obtained in elderly people who are over weight, it is wisest to give a guarded prognosis and to have the test repeated in six months or so. All diseases have an early stage, when correct diagnosis and treatment may save many months of disability.

The family history should be inquired into in all cases of glycosuria, as diabetes tends to run in families. Also with Jewish peoples there is a racial predisposition to disturbances in carbohydrate metabolism. Pentosuria also occurs in Jews and must be eliminated before disturbances of glucose metabolism are diagnosed.

The interpretation of sugar curves in these cases of diabetes and suspected diabetes must be undertaken with due regard for these facts and every aspect of each individual case should be considered before an opinion is given.

Finally, it is well to remember the words of Sir Rose Bradford: "Diabetes is not an entity but a clinical label attached to a number of different conditions with varied origin, different morbid anatomy and liable to follow different courses."

Pregnancy.

It will sometimes be found impracticable, owing to complaints of nausea or faintness, to carry out a glucose tolerance test on a pregnant woman fasting from twelve hours previously. A cup of sugarless tea or coffee given at least two hours previous to the carrying out of the test will prevent these symptoms and make very little, if any, difference to the results. Lactosuria should be eliminated when a reducing substance is found in the urine late in pregnancy or in the puerperium.

There are many factors which tend to upset the carbohydrate metabolism during pregnancy. The percentage of pregnant women showing glycosuria has been variously estimated by different authorities at from 5% to 45%. A large percentage of normal pregnant women who do not pass sugar on an ordinary diet, will pass it after the ingestion of fifty grammes of glucose and show a raised curve. In the early months emotional excitement may cause an increased breaking down of liver glycogen; also there is a tendency for a larger food intake to put an extra strain on liver and pancreas. In these cases curves corresponding to type (ii), (iii) or (iv) may be obtained after the ingestion of fifty grammes of glucose. Acetone is not usually present in the urine while the test is being carried out. If there is any family predisposition to diabetes, glycosuria may occur at any time during pregnancy, most frequently about the fifth or sixth month, and the curve obtained should correspond to that of type (v), with sugar and acetone in the urine, unless the condition is very mild. The tendency to acidosis, marked in even a normal pregnancy, is well seen in the cases with diabetes.

After the second trimester disturbances of the thyreoid and pituitary gland may cause glycosuria. If the thyreoid is causing the glycosuria, other diagnostic symptoms are usually present. The curves obtained correspond to those of type (ii) or (iv), and acetonuria is seldom present.

The disturbances due to overactivity of the pituitary may vary from a mild glycosuria with curves of type (ii) or (iv) to a condition indistinguishable from *diabetes mellitus* with a curve of type (v) and sugar and acetone in the urine while the test is being made. This type of diabetes has a better prognosis than true pancreatic diabetes, as it usually improves or may even disappear after delivery. It is apt, however, to recur in succeeding pregnancies. Treatment is similar to that followed in true diabetes.

Renal glycosuria is common during the latter months of pregnancy and the curve after the ingestion of fifty grammes of glucose is normal, but sugar is passed in the urine. This lowering of the renal threshold may complicate all the glycosurias of pregnancy and must be remembered when the curves are interpreted. Owing to the rapid excretion of the glucose by the kidneys, it is possible for the threshold to be so lowered that diabetes may be present and the curve still be within normal limits. The patients in these circumstances are difficult to render sugar-free and acetone is apt to be present throughout the making of the test.

There are certain rare cases of toxæmia of pregnancy of the hypertensive type which are characterized by a reduced carbohydrate tolerance with glycosuria. The prognosis in these cases is not clear.

Endocrine Disturbances.

Hyperthyreoidism.—Glycosuria and hyperglycæmia are comparatively common in hyperthyreoidism, and diabetes should not be diagnosed unless a curve of type (v) is obtained after fifty grammes of glucose have been taken and when sugar and acetone are present in the urine. Ketosis is rare in the glycosuria of hyperthyreoidism, as there is no deficeincy of oxidation, only of storage.

In hypothyreoidism carbohydrate tolerance may be increased.

Pituitary Disturbances.—With the better recognition of the many functions of the secretions of the pituitary gland, its influence on carbohydrate metabolism has been shown to be a definite factor and is now believed to be the primary cause of certain forms of glycosuria. In disease of the pituitary all degrees of disturbance may be met with, according to the stage of the disease and, although the result of the tolerance test may be a link in the chain of evidence leading to a correct diagnosis, it is of little value alone. An increased carbohydrate metabolism is seen at some stages of pituitary disease.

Suprarenal Glands.—The suprarenals are instrumental in causing the transient glycosuria due to emotion stimuli. The glucose tolerance test curve is usually quite normal, without any glycosuria occurring during the test. The glycosuria is present only when the person is excited or otherwise upset.

Renal Glycosuria.

Glycosuria due to lowering of the renal threshold for glucose is common and cannot be diagnosed without the application of a glucose tolerance test. The curve is always of type (i) and sugar is present in the urine at some stage during the performance of the test.

The various degrees of lowering of the threshold occur with about equal frequency, and glycosuria occurs with blood sugar values of from 0·1% to 0·16%. This anomaly may be congenital or acquired, and it seems fair to assume from evidence available that renal glycosuria and *diabetes mellitus* are not ætiologically related to each other in any way, though they may exist in the same patient. Also renal glycosuria may exist in patients with a strong family history of diabetes when there is no guarantee that diabetes will not develop later in life.

In renal glycosuria oxidation and storage are perfectly normal, but the permeability of the renal cells for glucose is altered. The cause is not definitely known; some authorities relate it to alterations in the calcium metabolism.

Infections.

The carbohydrate tolerance is always reduced in acute infections. The infectious origin of diabetes has partisans. Parotitis, pancreatitis and gall bladder disease are believed to be forerunners of diabetes. When septic foci are removed from diabetics the tolerance for carbohydrate is often greatly improved.

Occasionally glycosuria and hyperglycæmia occur in children and young adults after acute infectious diseases, which may show a curve of type (v) with glycosuria and acetonuria, but the prognosis is more favourable than in true diabetes.

Other Conditions.

Decreased carbohydrate tolerance with curves of types (ii) and (iv) has been shown to occur in carcinoma, nephritis, rheumatoid arthritis and other conditions in which the muscles are affected. Tests done on inmates of a mental asylum yielded a number of abnormal curves, many being of type (iii). In all of these conditions the curves are of very little, if any, aid in diagnosis, but are interesting from a scientific point of view.

EVA SHIPTON, B.Sc., M.B. (Sydney),
Pathologist, Royal South Sydney Hospital and Saint Margaret's Hospital for Women, Sydney.

British Medical Association News.

SCIENTIFIC.

A MEETING OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held on July 1, 1931, at the Medical Society Hall, East Melbourne, DR. VICTOR HURLEY, the President, in the chair.

Puerperal Sepsis.

DR. LUCY BRYCE read a paper entitled: "The Bacteriological Findings in Puerperal Sepsis" (see page 345).

DR. ARTHUR WILSON read a paper entitled: "Prophylaxis of Puerperal Fever" (see page 350).

DR. E. R. WHITE read a paper entitled: "Puerperal Sepsis: The Diagnosis and Treatment" (see page 352).

In opening the discussion, PROFESSOR MARSHALL ALLAN congratulated the readers of the papers and said that in recent publications the work of Dr. Lucy Bryce had received recognition and her name had now an honoured place in the literature of the bacteriology of puerperal sepsis. Agreeing with Dr. Wilson, Professor Allan said that in his opinion infection was usually introduced from outside sources and evidence in favour of autogenous infection was not supported by the investigations of most competent authorities. The mortality rate from puerperal sepsis in Victoria for last year was next to that for 1927, and both were higher than for the last twenty years. The rate was not decreasing.

With regard to the danger from droplet infection, face masks were largely used in Sydney for close operations, curettage, forceps application, induction with tubes *et cetera*, but not in the conduct of normal labour. Dr. Wilson had mentioned that the conditions in certain private hospitals had not appreciably improved.

The Victorian Commission of Public Health proposed to introduce new regulations providing for notification of puerperal pyrexia and wisely had given the profession the opportunity of expressing its opinion before enacting the new clauses. The subdivisions of the British Medical Association would have the opportunity of discussing the proposed regulations, and he commended them to the approval of the profession.

Professor Allan was of opinion that the use of common bed pans in hospitals was a possible source of cross-infection between patients.

Referring to the definition of puerperal pyrexia he pointed out that a normal temperature meant a normal temperature and not only one less than 100° F. The cause for any abnormal rise should be searched for carefully, and in any hospital it was necessary to take even slight rises in temperature seriously and investigate them thoroughly; as such minor abnormalities, occurring in a series of patients, were often the precursors of more serious conditions.

Referring to the treatment of puerperal sepsis by the instillation of glycerine and mercurochrome, Whitridge Williams, in the last edition of his text book, said that the matter was still *sub judice*. It did not seem that any attempt to sterilize the vagina by chemical agents would be of much use, and Professor Allan agreed with Dr. Wilson in his general advocacy of care and patience and his emphasis of the importance of the third stage of labour.

DR. FRANK L. DAVIES asked the opinion of the speakers as to the risk of carrying infection by the high forceps operation from a point low in the vagina to within the uterus. Would not the forceps blade carry infection inside the bag of membranes? He also asked about the danger of manually removing retained pieces of placenta and questioned whether the use of a common bed pan could be a source of cross-infection.

DR. B. MILNE SUTHERLAND congratulated the readers of the papers, which were so complete that they did not leave much to be said. He agreed that it was important to guard against exposure of the mother to cold during confinement, and in this connexion it was necessary to prevent the bed becoming soaked by escaping *liquor amnii*. In cleaning up the vulva it was undesirable to use small swabs and so risk infecting the gloves and carrying the infection to other parts. Sometimes episiotomy was performed without adequate aseptic precautions, and it should be remembered that septicæmia might result from this neglect as well as from other faults.

Referring to the possibility of autogenous infection during labour or the puerperium, Dr. Sutherland said that sections made from a cervix which had been the seat of a long-standing infection, revealed *Streptococcus pyogenes* in the racemose glands. It was conceivable that, with the great stretching during labour, these organisms could be forced out and so cause uterine infection.

Two other great predisposing causes of infection were nephritis and anæmia. Hæmorrhage which resulted from partial separation of the placenta during the third stage of labour, was an important cause of exhaustion and should be treated at once by manual removal. In doing this it was advisable to pass the membranes in advance of the gloved hand and so separate the placenta without having actually touched the uterine walls.

Referring to the typical range of temperature in various types of puerperal infection, Dr. Sutherland said that the typical chart in infection with the *Streptococcus hæmolyticus* was one with high temperatures and big remissions. In *Staphylococcus aureus* infections the temperature was typically of the typhoid type with remissions of one or two degrees Fahrenheit, the temperature reaching to about 103° F. In infections by the *Staphylococcus albus* the temperature was not so high. With regard to the therapeutic value of intravenous transfusions, the blood titre in immune bodies and complement had been found to be reduced by the third or fourth day after transfusion, and this had to be met by repeated transfusions. The leucocytic power of the injected blood could be increased by giving the donor 2·5 cubic centimetres of nuclein four hours before transfusion.

In his opinion local treatment with glycerine was of definite value. The essential factor was drainage, and the glycerine increased the tone of the muscles, tended to make the lumen of the parturient canal more circular, and relieved blockage by retained secretions. The glycerine was injected once or twice a day into the cervical canal, a gum elastic catheter being used through a speculum, with the patient in the Sims position.

DR. ROY CHAMBERS expressed his appreciation of all the papers, which were informative and comprehensive. He joined with Dr. Wilson in emphasizing the importance of prophylaxis, and mentioned one further small but important point in avoiding sepsis. In making a vaginal examination, especially in the restless stage after the enema had been given, and when infection from the anus was likely to occur, it was best to have the patient lying on her back, giving good vision of the field, and with the labia well separated before introducing the fingers. For the same reason the patient was best placed in the dorsal position for forceps operations, as this position was easier and offered advantages both to the operator and to the nurse.

DR. PERCY BRETT thanked the readers of the papers, and said that he thought that at the present time there was more sepsis in hospitals than in private houses. During his own rather long experience of midwifery general opinion, including his own, in the early days had favoured private houses and later had swung in favour of hospitals. More recently, however, the statistics for sepsis had led to a return of the private house to favour as the best place for confinements. In the private house it was a good idea to have two nurses in attendance at the time of confinement. One could be a visiting nurse, and the arrangement was a great help, especially in avoiding sepsis.

DR. VICTOR HURLEY, the President, before calling on the speakers to reply, expressed the members' appreciation of the three papers.

Dr. Bryce, in reply, said that she thought that the streptococci found in the sections from the cervix in the case quoted by Dr. Sutherland could not be proved to be hæmolytic or non-hæmolytic, though the latter might cause mild sepsis.

Dr. Wilson, in reply to Dr. Frank Davis, said that in the high forceps operation the blades of the forceps would not necessarily pass inside the membranes, and it was therefore not always possible to avoid carrying infection to the uterus.

Dr. Edward White, in reply, said he entirely agreed with the remark that early diagnosis of sepsis was important, so as to place the patient suitably for proper nursing and treatment. Many women were admitted into hospital too long after the onset of an acute infection, when it was too late to get any response to treatment.

Dr. Sutherland had remarked upon the usefulness of the lotion bowl during confinement. Even in the cottage, where, after all, most confinements occurred, the *accoucheur*, almost unaided, could carry out any necessary manipulations with safety, provided that the gloved hands were constantly washed quickly in a strong germicidal lotion.

Dr. White stated that he saw in the Chicago Lying-in Hospital, presided over by De Lee, the most perfect practice of asepsis and antisepsis in obstetrics. Even after a normal child-birth, the gloved hands were dipped first into pure lysol and then washed before the third stage was commenced.

He said that it was not uncommon to press down too firmly upon the fundus in the third stage in *multipara*, which pushed the cervix out at the vulva, where cervical infection might easily occur.

Some men informed him that, though they often broke many of the golden rules of obstetrics, yet they had not had any septic infection in a large obstetrical practice. Dr. White in these instances felt that he would like to know what their real morbidity rate was; moreover, in the past a high bactericidal power of the blood had possibly counteracted any serious infection. But some day, when virulent hæmolytic streptococci were commonly abroad during an epidemic of scarlet fever and tonsillitis, a careless routine in obstetrics would break down and acute sepsis would result.

With regard to the possibility of autogenous infection occurring from a chronic cervicitis, he had particularly stressed that point in a previous paper. Mention had been made about lochia being dammed up in the uterus during the puerperium. In his experience this was most unusual, provided that proper postural treatment was undergone as a routine. As a matter of fact, whilst taking a series of intrauterine cultures from sixty consecutive cases of puerperal sapræmia and sepsis, he had very rarely noticed even a small gush of lochia from the uterine cavity. But Dr. White agreed that the intrauterine glycerine therapy of Remington Hobbs was a valuable aid in the few cases of sapræmia that did not readily respond to the ordinary conservative treatment, and was very useful in endometritis complicated by a free purulent discharge. Dr. White felt that the risk of "droplet" infection was a real one, particularly during the third stage of labour. Consequently the wearing of face masks by the attendants was an easy and necessary precaution to take.

NOMINATIONS AND ELECTIONS.

THE undermentioned has been nominated for election as a member of the New South Wales Branch of the British Medical Association:

Saunders, Arthur Clive, M.B., B.S., 1931 (Univ. Sydney), Parramatta District Hospital.

Obituary.

HENRY FREDERICK HARVEY.

WE regret to announce the death of Dr. Henry Frederick Harvey, which occurred at Perth, Western Australia, on August 29, 1931.

JOHN BASS GRAHAM.

WE regret to announce the death of Dr. John Bass Graham, which occurred at Bowral, New South Wales, on September 9, 1931.

FRANK ALEXANDER BENNET.

WE regret to announce the death of Dr. Frank Alexander Bennet, which occurred on September 13, 1931, at Woollahra, New South Wales.

Correspondence.

A CORRECTION.

SIR: In the last paragraph but one of my article on perimetry the reference to Colonel Elliot's paper in the *Proceedings of the Ophthalmological Society*, 1919, should be 1918. The mistake was mine.

Yours, etc.,

E. TEMPLE SMITH.

141, Macquarie Street,
Sydney.

THE IMPORTANCE OF AIR-BORNE INFECTIONS.

SIR: A recent investigation into an epidemic of cerebro-spinal meningitis in the Royal Air Force illustrates the method of spread of the meningococcus in the stagnant air of an overcrowded canteen.

An American's work on the causation of the "rheumatisms" was reviewed in a leading article in *The British Medical Journal* lately. The reviewer's conclusions were favourable to the thesis that rheumatic fever, "muscular rheumatism," fibrositis and the rest are due to the growth of a streptococcus in the naso-pharynx; that this coccus is transmitted in temperate climates in conditions of overcrowding favourable to air-borne infection.

I readily accept the conclusions in both articles. In 1916 I was helping to investigate cerebro-spinal meningitis in the soldiers' camps here, and was convinced of the evil effect of overcrowding and of the widespread diffusion of the meningococcus in the throats of privates, among whom there was more overcrowding than in the higher ranks. In treating chronic rheumatic infections I have acted on the theory expressed in the second article by injecting autogenous vaccines made from cultures of organisms grown from the naso-pharyngeal mucus, with quite good results.

Now the prevalence of alleged "influenza" in the cities all the year round is well known. Many of these febriculæ are found to be due to streptococci, pneumococci, meningococci and allied organisms. Clinically they appear frequently to be the start of more serious organic disease. As

infection by water-borne and food-borne organisms is now quite infrequent, I suggest that the subject of air-borne infections is well worthy of investigation by our research workers. I can conceive it possible that much light would be thrown on the mode of onset of tuberculosis and on the lighting up of old tuberculous lesions, on the causation of arteriosclerosis, and even on the secret of malignant tumours. In regard to the latter, a writer in England wished it to be remembered, when the cause of cancer should have been finally discovered, that he had stated that one of the prime facts predisposing to cancer is lymphatic stasis. The connexion of lymphatic stasis with progressive arteriosclerosis is not difficult. Arteriosclerosis is thought to be due to an intoxication. The American worker already referred to has shown that a streptococcus growing in the naso-pharynx can produce an intoxication affecting at least fibrous and muscular tissue.

What a field for speculation and investigation these ideas open up!

Yours, etc.,

ROY F. WATSON.

249, Glenferrie Road,
Hawthorn,
Victoria.
September 5, 1931.

Diary for the Month.

SEPT. 22.—New South Wales Branch, B.M.A.: Medical Politics Committee.
SEPT. 23.—Victorian Branch, B.M.A.: Council.
SEPT. 24.—South Australian Branch, B.M.A.: Branch.
SEPT. 24.—New South Wales Branch, B.M.A.: Branch.
SEPT. 25.—Queensland Branch, B.M.A.: Council.
OCT. 1.—South Australian Branch, B.M.A.: Council.
OCT. 2.—Queensland Branch, B.M.A.: Branch.
OCT. 6.—New South Wales Branch, B.M.A.: Organization and Science Committee.
OCT. 6.—New South Wales Branch, B.M.A.: Council (Quarterly).
OCT. 7.—Victorian Branch, B.M.A.: Branch.
OCT. 8.—New South Wales Branch, B.M.A.: Clinical Meeting.
OCT. 8.—Victorian Branch, B.M.A.: Council.
OCT. 13.—New South Wales Branch, B.M.A.: Ethics Committee.

Medical Appointments.

Dr. F. W. Baker (B.M.A.) has been appointed Medical Officer of Health by the North Fremantle Municipal Council, Western Australia.

* * *

Dr. B. T. Mayes (B.M.A.) has been appointed Superintendent of the Boonah District General and Maternity Hospital, Boonah, Queensland.

* * *

The following appointments have been made to the staff of the Royal Alexandra Hospital for Children, Sydney, New South Wales: Honorary Radiographer, Dr. W. B. Dight (B.M.A.); Honorary Assistant Radiographer (Senior), Dr. B. P. Anderson Stuart (B.M.A.); Honorary Assistant Radiographer (Junior), Dr. K. B. Voss (B.M.A.); Honorary Ophthalmic Surgeon, Dr. N. M. Gregg (B.M.A.); Honorary Assistant Ophthalmic Surgeon, Dr. L. H. Stanton-Cook (B.M.A.); Honorary Relieving Assistant Ophthalmic Surgeon, Dr. W. M. C. MacDonald (B.M.A.).

Medical Appointments Vacant, etc.

FOR announcements of medical appointments vacant, assistants, *locum tenentes*, sought, etc., see "Advertiser," page xiv.

BALONNE HOSPITALS BOARD, QUEENSLAND: Medical Officer.

LAUNCESTON PUBLIC HOSPITAL, TASMANIA: Resident Medical Officer (male).

PERTH HOSPITAL, PERTH, WESTERN AUSTRALIA: Junior Resident Medical Officers.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company, Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Members desiring to accept appointment in ANY COUNTRY HOSPITAL, are advised to submit a copy of their agreement to the Council before signing, in their own interests. Brisbane Associated Friendly Societies' Medical Institute. Mount Isa Mines. Toowoomba Associated Friendly Societies' Medical Institute.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge Appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 65, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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